# THE JOURNAL OF GAS LIGHTING
## WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LVII. No. 1457.] LONDON, APRIL 14, 1891. [43RD YEAR. Price 6d.



**WOLSTON'S** Paste and Ready Mixed for Use. Guaranteed Free from Adulteration. **TORBAY PAINTS.**

**FOR GASHOLDERS, &c., &c.**

**The Original "Torbay Paints"** As supplied during the present and many preceding years to the LONDON GASLIGHT & COKE COMPANY.

*Special Quotations to Gas Companies.*

**TORBAY & DART PAINT Co., Ld.,**
23, Gt. George St., Westminster, S.W.
Works: DARTMOUTH, DEVON.

— ESTABLISHED 1830. —
**PARKER & LESTER,**
Manufacturers & Contractors.

THE ONLY MAKERS OF
**PATENT ANTIMONY PAINT,**
**Parker's Imperial Black Varnish,**
*Oxide Paints, Oils, and General Stores for Gas and Water Works.*

WORKS:
ORMSIDE STREET, OLD KENT ROAD, LONDON.

**Ashmore, Benson, Pease, & Co., Ld.,**
STOCKTON-ON-TEES,
Manufacturing Gas Engineers.
*See Advertisement, p. 718.*

**CEMENT**
**EARLE'S**
BEST
**Portland Cement**
MANUFACTURED BY
**GEO. & THOS. EARLE,**
**HULL.**
Office: 7, PIER STREET.
Works: WILMINGTON.
STOREAGE CAPACITY 10,000 Tons.
ESTABLISHED 1811—OVER THREE QUARTERS OF A CENTURY.
Telegraphic Address: "CEMENT HULL."

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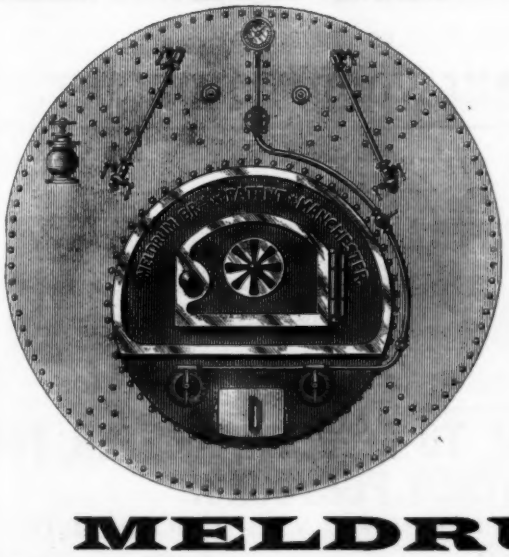
**"ABYSSINIAN" & ARTESIAN TUBE WELLS,**
FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
The following Town Water-Works Supplies have been obtained by this System, viz.:—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.
**LE GRAND & SUTCLIFF,**
HYDRAULIC ENGINEERS, 100, BUNHILL ROW, LONDON, E.C.

**SELF-CONTAINED DUST FUEL FURNACE.**



OVER 200 WORKING,
RAISING STEAM WITH COKE DUST, COAL DUST, TOWNS' REFUSE, AND OTHER WASTE FUEL.

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LONDON: WM. BOBY, 16, Union Court, Old Broad Street.
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**MELDRUM BROS.,**
**ATLANTIC WORKS, CITY ROAD, MANCHESTER.**

# DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

## GASHOLDER & BOILER WORKS,

**WEST BROMWICH, NEAR BIRMINGHAM**

(ESTABLISHED 1765).

## MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

*PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,*

**Wrought-Iron Roofs, Bridges, Girders, &c.,**

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

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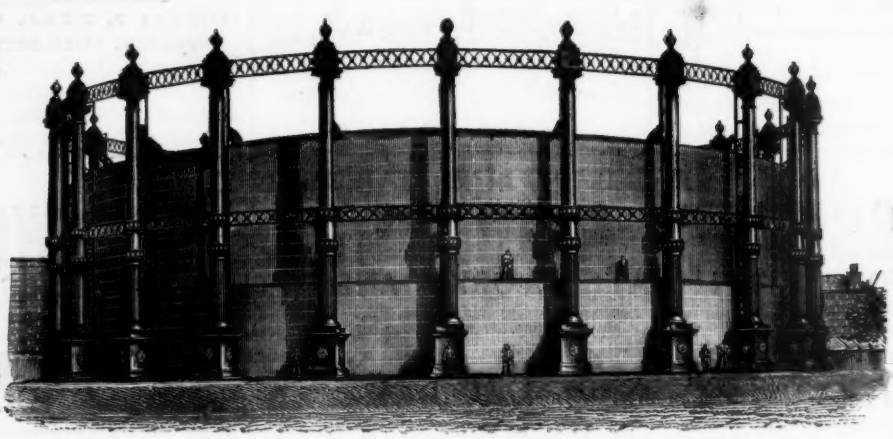
TELEGRAPHIC ADDRESS: "COCKEY'S FROME."

# EDWARD COCKEY & SONS, Ld.,

ESTABLISHED OVER HALF A CENTURY.

## GAS ENGINEERS, IRONFOUNDERS, & CONTRACTORS,

*Manufacturers of* GASHOLDERS and TANKS, BOILERS and ENGINES, ROOFS, EXHAUSTERS, BREEZE SCREENS, CHARGING and COKE BARROWS.



*Manufacturers of* PATENT WASHERS, PATENT VALVES for PURIFIERS, &c., GOVERNORS, LAMP COLUMNS, Weighbridges, COKE BREAKERS.

**SOLE MAKERS OF COCKEY AND SMITH'S PATENT SELF-ACTING BYE-PASS VALVES.**

*Estimates for any description of Gas Plant on application.*

**THE IRON-WORKS, FROME SELWOOD, SOMERSET.**

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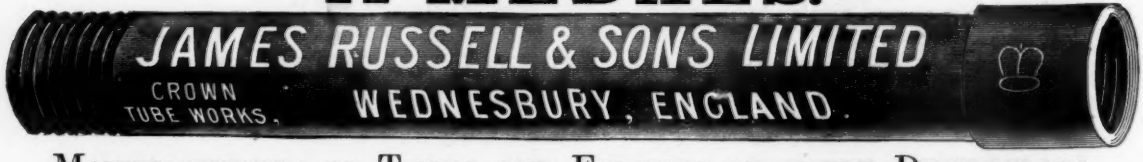
*HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.*

**—11 MEDALS.—**




MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

**WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.**

SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

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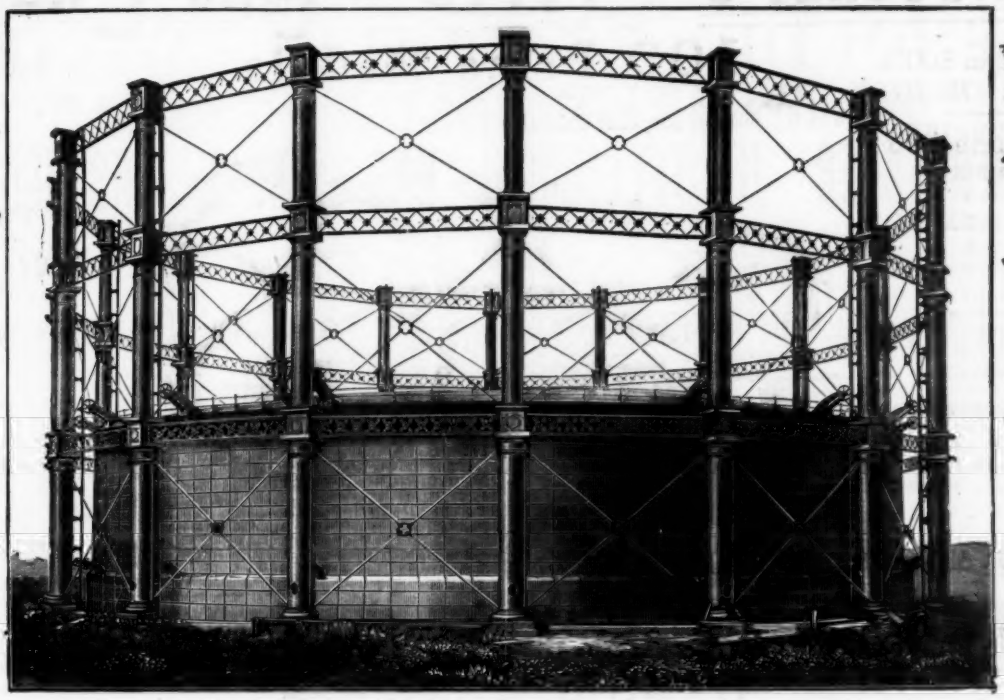

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OVER 500 GASHOLDERS HAVE BEEN SUPPLIED AND ERECTED,

INCLUDING THOSE SUPPLIED TO THE FOLLOWING GAS COMPANIES AND CORPORATIONS:

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| BECKTON. | BRADFORD. | CARDIFF. | LEEDS. | NOTTINGHAM. | RIO GRANDE. | SYDNEY. |
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# GAS COAL.

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REAL OLD SILKSTONE GAS COAL,

Address, THE STRAFFORD COLLIERIES COMPANY,

Near BARNSLEY, SOUTH YORKSHIRE.

# NEWTON, CHAMBERS, & CO., LIMITED

THORNCLIFFE IRON-WORKS, near SHEFFIELD,

MANUFACTURERS OF

SLIDE VALVES, WITH RACK & PINION, OR Internal or External SCREWS, of all Sizes.

GASHOLDERS, AND Gasholder Tanks.

CAST-IRON RETORTS,

RETORT-BED FITTINGS,

*And Retort-House Appliances*

of every description.

Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.

WROUGHT AND CAST IRON CONDENSERS, SCRUBBERS, & WASHERS,

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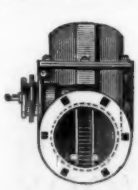
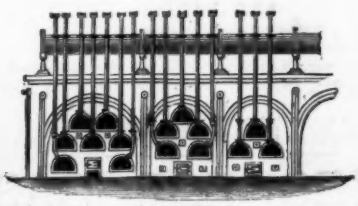
PATENT CENTRE VALVES

for working Purifiers.

Also Bye-Pass & Stop Valves.





PURIFIERS with Planed Joints,

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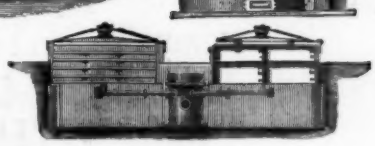


DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

# CROSSLEY'S "OTTO" GAS-ENGINE.

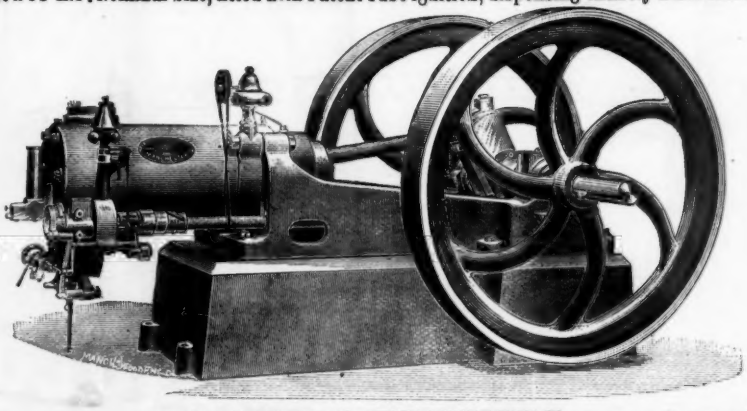
**100 Prize Medals.**

**MADE in SIZES** *2-Man to 100-HP.*

**GAS-ENGINES** COMBINED WITH **PUMPS** FOR TOWNS SUPPLY, SEWAGE, &c., &c.

**GAS-ENGINES** COMBINED WITH **AIR COMPRESSORS** FOR THE SHONE SEWAGE SYSTEM, LUCIGEN LIGHT, &c.

New 14-H.P. Nominal Size, fitted with Patent Tube Ignition, dispensing entirely with Plates.



**MADE in SIZES** *2-Man to 100-HP.*

VERTICAL AND HORIZONTAL TYPES.

**ENGINES** *COMBINED* WITH HOISTS, PUMPS, DYNAMOS, &c., &c.

*Largely used for EXHAUSTING, PUMPING, COKE CRUSHING, ELECTRIC LIGHTING,* &c., &c.

**Over 31,000 "OTTO" ENGINES are at work.**

**CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER,**

LONDON, LIVERPOOL, GLASGOW, NEWCASTLE, BIRMINGHAM, HULL.

## HARRIS & PEARSON,

**STOURBRIDGE, ENGLAND.**

MANUFACTURERS OF

**FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.**

GLAZED BRICKS AND PORCELAIN BATHS.

# SAML. CUTLER & SONS, ENGINEERS.

**ALL GASHOLDERS**

**Should be fitted with**

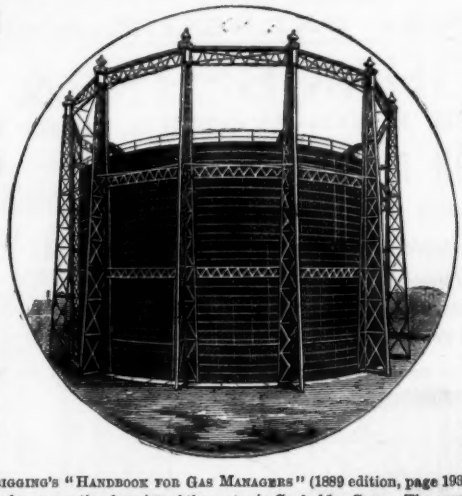
CUTLER'S PATENT FREEZING PREVENTER

**Which has been**

**APPLIED MOST SUCCESSFULLY**

**At**

LONDON GASLIGHT AND COKE COMPANY; IMPERIAL CONTINENTAL GAS ASSOCIATION; BROMLEY (KENT); YARMOUTH; HERTFORD; KING'S LYNN, &c., &c.



**TESTIMONIALS.**

Mr. WILLIS, of the Great Yarmouth Gas-Works, writes:

"We had a very sharp frost last night, which gave us a fair opportunity of testing the steam arrangement to Gasholder. You will be pleased to hear it was very effective; in fact, doing all we require."

Mr. Dow, King's Lynn, writes on Jan. 7, 1891:

"The apparatus you fixed to our Gasholder for preventing the water freezing in the cups has had a very good test the last few weeks' severe weather; and it gives me much pleasure to inform you that we have not had the least trouble with ice, and that it is a perfect success."

C. WOODALL, Esq., Palace Chambers, Westminster, writes on Jan. 10, 1891:

"I have fitted to several Gasholders your special apparatus for conveying steam to the cups, and preventing freezing; and it has proved satisfactory."

NEWBIGGING'S "HANDBOOK FOR GAS MANAGERS" (1889 edition, page 193) says:

"Messrs. S. Cutler & Sons have devised an apparatus for preventing freezing of the water in Gasholder Cups. The arrangement is self-acting, compact, and trustworthy."

## CUTLER'S SPECIALITIES FOR GAS-WORKS:

**MORRIS & CUTLER'S PATENT CONDENSER—The best obtainable.**
**LIVESEY & TANNER'S TAR AND LIQUOR OVERFLOWS.**
**CUTLER'S PATENT WATER-VALVES FOR PURIFIERS, &c.**
**EVERY REQUIREMENT FOR GAS-WORKS AND WATER-WORKS.**

Offices: 16, GREAT GEORGE STREET, WESTMINSTER, S.W.
Works: PROVIDENCE IRON-WORKS, MILLWALL, LONDON.
TELEGRAMS: "RETORTUS LONDON."

**JOSEPH CLIFF & SONS,**

INCORPORATED IN THE LEEDS FIRE-CLAY COMPANY, Ltd.,

WORTLEY, LEEDS.

LONDON Offices & Depôts:
*Baltic Wharf, Waterloo Bridge.*

WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.

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*16, Lightbody Street.*

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*Queen Street.*

**MACHINE-MADE RETORTS**

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

**Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.**

ESTABLISHED MORE THAN A QUARTER OF A CENTURY

WORKS HUNSLET, LEEDS

LONDON OFFICE: 60, QUEEN VICTORIA STREET E.C.

**CLAYTON SON & CO. LTD.**

MAKE A

SPECIALTY OF

GASHOLDERS

AND MAKERS OF

REG? TELEGRAPHIC ADDRESS: "GAS LEEDS"

**GAS PLANT** OF EVERY DESCRIPTION.

# THE WIGAN COAL & IRON CO., LIMTD.,

**Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.**

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TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.

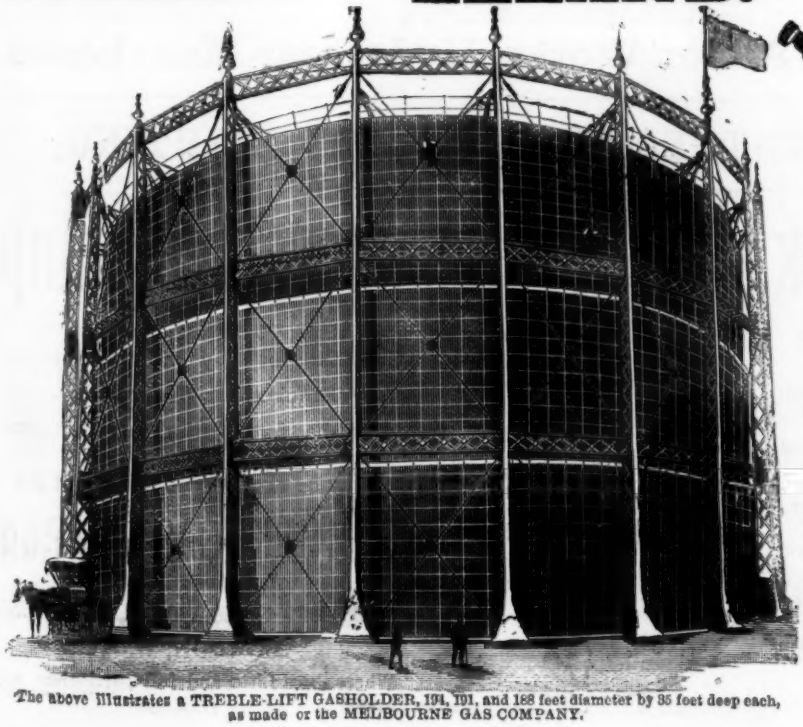
LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.

TELEGRAPHIC ADDRESS: "PARKER LONDON."

# R. DEMPSTER & SONS, Ltd.,

## ROSE MOUNT GAS ENGINEERING WORKS,

ESTABLISHED — **ELLAND.** — 1855.



The above Illustrates a TREBLE-LIFT GASHOLDER, 194, 191, and 188 feet diameter by 35 feet deep each, as made or the MELBOURNE GAS COMPANY.

GAS AND CHEMICAL PLANT OF EVERY DESCRIPTION — ALL SUNDRIES SUPPLIED.

OUR

**ROTARY EXHAUSTERS**

Are acknowledged to excel in efficiency and finish.

OUR IMPROVED

**COKE-BREAKING MACHINE**

Is a pronounced success.

Designs, Specifications, and Estimates submitted on application to

**R. Dempster & Sons,** Ltd.,

ELLAND.

# JOHN HALL & CO.,

**STOURBRIDGE,**

**MANUFACTURERS OF FIRE-BRICKS, LUMPS, TILES,**

**AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.**
**RETORTS CAREFULLY PACKED FOR SHIPMENT.**
**A STOCK OF DIFFERENT SHAPES ON HAND.**

# GAS AND WATER PIPES

AND

# CASTINGS OF EVERY DESCRIPTION.

**MANUFACTURED BY THE**

# CLAY CROSS COMPANY,

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| MARK. | CLAY CROSS. | 130, GT. SUFFOLK ST., S.E. |

# SULPHATE OF AMMONIA.

By Her Majesty's Royal Letters Patent.

# DR. FELDMANN'S APPARATUS

**The most successful and approved Apparatus known up to the present time.**

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO THE

**Sole Agents and Manufacturers,**

## GODDARD, MASSEY, & WARNER,

**ENGINEERS,**

**NOTTINGHAM.**

**The Apparatus has been supplied to the following Firms—**

BURT, BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (4 Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

**And to the following Gas Companies and Corporations—**

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| ILKESTON. | BURY. | CHORLEY. |
| WIDNES. | BRIGHOUSE. | WHITEHAVEN. |
| HALIFAX. | MARKET HARBRO'. | CHESTER. |
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# RUSCOE'S PATENT MACHINE

**FOR DRILLING AND TAPPING WATER-MAINS AND GAS-MAINS UNDER PRESSURE.**

Patent Saddle Back and Drilling Apparatus, whereby Gas and Water Mains can have 2-in., 3-in., 4-in., 5-in., and 6-in. Branches put on without loss of Water or Gas.

**Sole Maker of HELPS' PATENT PIPE EXTRACTOR.**

Prices and Particulars on Application to

## JOHN RUSCOE, Albion Works, Hyde, near Manchester.

## SIXTY PER CENT. ECONOMY IN GAS LIGHTING.

# The Schülke Regenerative Lamp

FOR

**DOMESTIC AND EXTERNAL LIGHTING.**

The only Regenerative Lamp employing the Common Flat-Flame Burners.

Lamps giving 20-Candle power consume less than four feet of Gas per hour.

**PURE WHITE & PERFECTLY STEADY LIGHT,**

NOT AFFECTED BY DRAUGHTS.

Suitable for any existing fittings (Brackets or Suspending).

Can be fixed in a few minutes.

May be seen at the Offices of the

## SCHÜLKE GAS-LAMP Co.

LIMITED,

**20, HIGH HOLBORN,**

**LONDON, W.C.,**

Where Price Lists and full particulars may be obtained.

# KIRKHAM, HULETT, & CHANDLER'S, LTD.,

[SIDNEY HERSEY, Managing Director.] **NEW PATENT** [J. CHANDLER, Engineer.]

# "STANDARD" WASHER-SCRUBBERS

**Have now been supplied to the following Gas Companies and Corporations: The Gaslight and Coke Company; Liverpool, West Ham, Derby, Cambridge, Lowestoft, and Melbourne Gas Companies; Manchester, Glasgow, Rochdale, Workington, Rawmarsh Corporations, &c., &c., &c.**

Original pattern "STANDARD" Washer-Scrubbers have been altered and improved—by the Company's new patent Washing Devices ("Bundles") being fitted—at the following Gas-Works: The Gaslight and Coke Company's Beckton, Nine Elms, Shoreditch, Pimlico, and Bromley Stations; Birmingham, Nottingham, Edinburgh, West Ham, Melbourne, Croydon, Maidstone, Harrow, Buxton, Kingston-on-Hull, &c., &c., &c.

THESE IMPROVED "BUNDLES" ARE CONSTRUCTED CHIEFLY OF WOOD AND TO TEMPLATES OF ORIGINAL IRON "BUNDLES," AND CAN BE EASILY FITTED IN PLACE OF THE LATTER BY UNSKILLED LABOUR.

ADDRESS: **PALACE CHAMBERS, BRIDGE STREET, WESTMINSTER, S.W.**

# R. & J. DEMPSTER,

**GAS PLANT WORKS, NEWTON HEATH, MANCHESTER,**

MAKERS AND ERECTORS OF

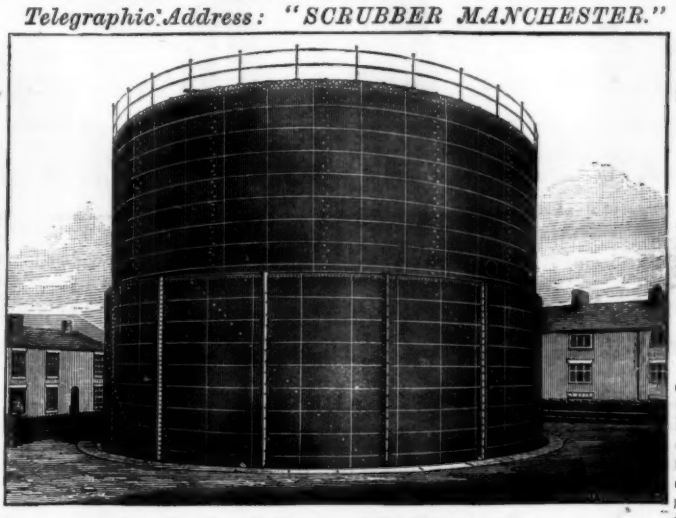
## PATENT COLUMNLESS GASHOLDERS.

*Telegraphic Address: "SCRUBBER MANCHESTER."*

**TOTAL WEIGHT REDUCED** from 30 per cent. to 50 per cent.

**TRANSPORT AND ERECTION REDUCED** to the same extent; and in cases where gasholders are shipped abroad to places difficult of access, this represents a very large amount of money.

**TANK CONSTRUCTION SIMPLIFIED.** The Tank wall (of whatever construction) is a regular cylinder. There are no piers needed, and all expensive foundation stones for the base of columns or standards are dispensed with.



Two-Lift Gasholder erected at the Gas-Works, Northwich, which has been in continuous work since Jan. 3, 1890, and has been subjected to most severe tests from heavy gales, with perfectly satisfactory results.

**COST OF PAINTING SAVED** for the Columns and Girders.

**TILTING UTTERLY IMPOSSIBLE;** And as there are fewer parts, there is less liability for the Gasholder to get out of order in working.

**STABILITY UNDER WIND PRESSURE** of a Gasholder constructed upon this system is at least equal to, and from experiments and calculations made is far in excess of, that of a Holder of the same dimensions guided by the elaborate guide framing at present in use.

The removal of heavy guide carriages and rollers from the top curbs considerably lowers the centre of gravity of the structure, and dispenses with the extra strength of sheeting necessary to carry these at the points where they are attached to the gasholder.

The plan adapts itself to telescoping to any reasonable extent, and enables very shallow holders or lifts to be employed with perfect stability.

**FOR FURTHER PARTICULARS AND ESTIMATES, APPLY TO THE ABOVE.**

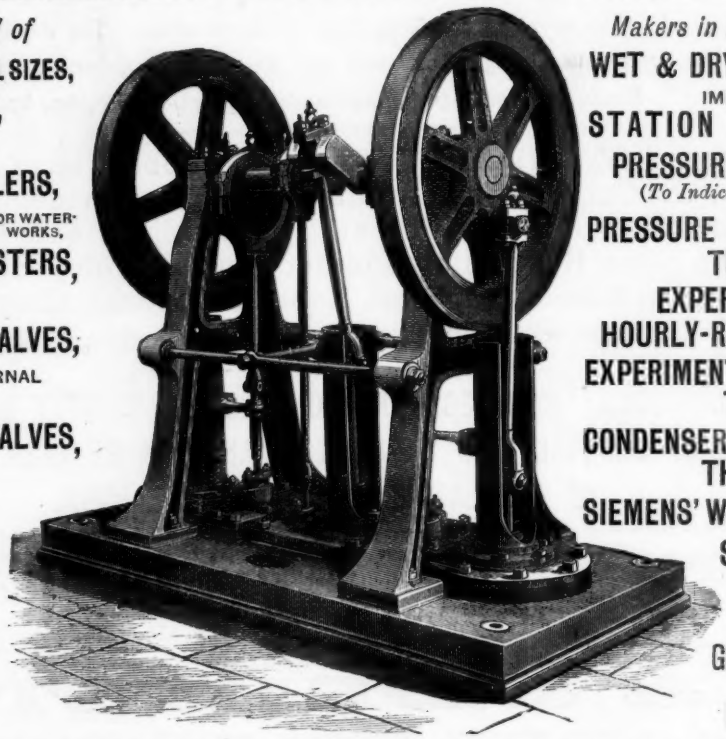
# R. LAIDLAW & SON,

## GAS AND WATER ENGINEERS.

Manufacturers of **GAS APPARATUS** of every Description.

*Makers in GLASGOW of*

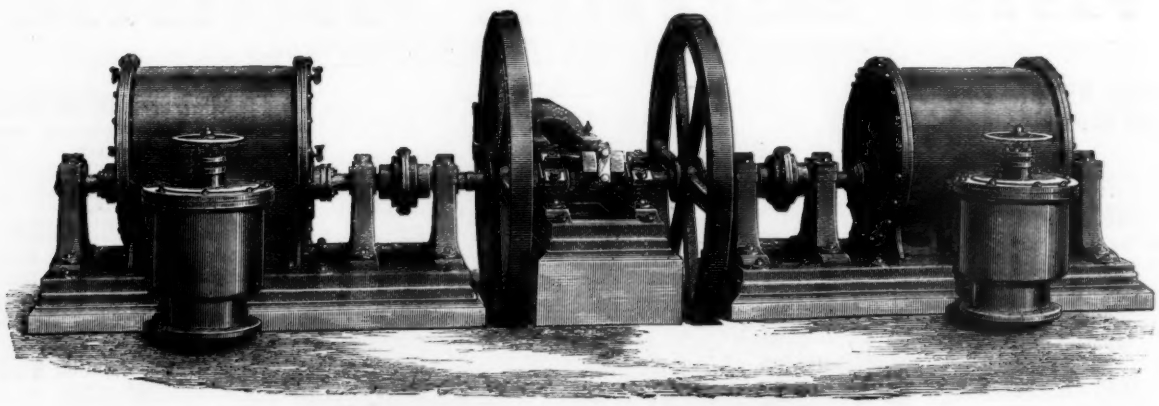
CAST-IRON PIPES, ALL SIZES,
LAMP PILLARS,
STEAM-ENGINES AND BOILERS,
PUMPING ENGINES FOR WATER-WORKS,
BEALE'S GAS EXHAUSTERS,
DOUBLE-FACED SLUICE VALVES,
INTERNAL AND EXTERNAL RACK OR SCREW SLIDE VALVES,
CAST-IRON COLUMNS,
BEAMS, GIRDERS, AND WATER-TANKS,
WROUGHT-IRON TUBES, FITTINGS, &c.



*Makers in EDINBURGH of*

WET & DRY GAS-METERS,
IMPROVED STATION GOVERNORS,
PRESSURE REGISTERS
*(To Indicate New Time)*,
PRESSURE GAUGES,
TEST HOLDERS,
EXPERIMENTAL HOURLY-RATE METERS,
EXPERIMENTAL TEST METERS,
CONDENSER THERMOMETERS,
SIEMENS' WATER-METERS,
STREET LANTERNS,
*And all Kinds of*
GAS APPARATUS AND FITTINGS, &c.

PUMPING GAS EXHAUSTER AND ENGINE COMBINED. All Sizes.



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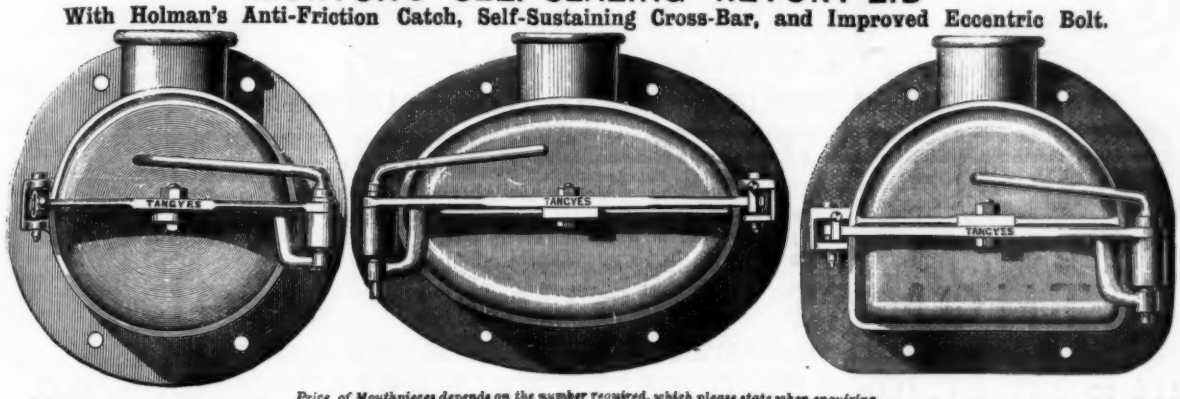
## MORTON'S SELF-SEALING RETORT-LID

**With Holman's Anti-Friction Catch, Self-Sustaining Cross-Bar, and Improved Eccentric Bolt.**




*Price of Mouthpieces depends on the number required, which please state when enquiring.*

These Retort Lids and Fastenings are in extensive use in most of the Gas-Works in Great Britain, America, and on the Continent, and have almost entirely displaced the older method of sealing by a luting of lime or other material. The Lids are made in three forms, round, oval, and D (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these lids are recommended to make their selection, in order to avoid cost of pattern making, delays, &c., &c.

### Mouthpieces with Circular Lids for Round Retorts.

| Pattern No. | Diam. Mouth. | Internal Dimensions of Retort. | Length of Mouthpiece. | Lid and Fittings without Mouthpiece. |
|---|---|---|---|---|
| 3494 | 14 ins. | 14 ins. | 12½ ins. | £0 19 0 |
| 2982 | 15 ,, | 15 ,, | 14 ,, | 1 0 0 |
| 3453 | 15 ,, | 15 ,, | 12⅝ ,, | 1 0 0 |
| 3497 | 15 ,, | 15 ,, | 15 ,, | 1 0 0 |
| 3630 | 16 ,, | 16 ,, | 10½ or 11⅜ ,, | 1 1 0 |
| 4549 | 16 ,, | 16 ,, | 15⅛ ,, | 1 1 0 |
| 6262 | 16 ,, | 16 ,, | 13⅝ ,, | 1 1 0 |
| 6396 | 16 ,, | 16 ,, | 15 ,, | 1 1 0 |
| 7668 | 16 ,, | 16 ,, | 17⅝ ,, | 1 1 0 |
| 10289 | 16 ,, | 16 ,, | 11 ,, | 1 1 0 |
| 8356 | 17 ,, | 17 ,, | 15 ,, | 1 3 0 |
| 7125 | 17 ,, | 17 ,, | 6 ,, | 1 3 0 |
| 933 | 18 ,, | 18 ,, | 11⅜ ,, | 1 5 0 |
| 4045 | 18 ,, | 18 ,, | 14 ,, | 1 5 0 |
| 6397 | 18 ,, | 18 ,, | 15 ,, | 1 5 0 |
| 8013 | 18 ,, | 18 ,, | 15 ,, | 1 5 0 |

### Taper Circular Mouthpieces with Circular Lids for Round Retorts.

| | Front. Back. | | | |
|---|---|---|---|---|
| 13001 | 15 to 21 ins. | 21 ins. diam. | 13½ ins. | £1 0 0 |
| 13261 | 15 ,, 24 ,, | 16 ,, | 13½ ,, | 1 0 0 |
| 12995 | 15 ,, 30 ,, | 30 ,, | 13 ,, | 1 0 0 |
| 9562 | 18 ,, 21 ,, | 21 ,, | 12½ ,, | 1 5 0 |
| 10425 | 18 ,, 21 ,, | 21 ,, | 4½ ,, | 1 5 0 |
| 13418 | 18 ,, 22 ,, | 22 ,, | 12 ,, | 1 5 0 |
| 13396 | 20 ,, 20⅝ ,, | 20⅝ ,, | 4 ,, | 1 11 0 |

### Mouthpieces with Circular Lids for D Retorts.

| Pattern No. | Diam. Mouth. | Internal Dimensions of Retort. | Length of Mouthpiece. | Lid and Fittings without Mouthpiece. |
|---|---|---|---|---|
| 5348 | 14 ins. | 14 × 13 ins. | 7 ins. | £0 19 0 |
| 14209 | 14 ,, | 14 ,, 13 ,, | 13½ ,, | 0 19 0 |
| 14231 | 14 ,, | 12⅝ ,, 12⅝ ,, | 10 ,, | 0 19 0 |
| 3463 | 15 ,, | 15 ,, 13 ,, | 14 ,, | 1 0 0 |
| 6678 | 15 ,, | 15 ,, 14 ,, | 12 ,, | 1 0 0 |
| 3661 | 15½ ,, | 15½ ,, 13 ,, | 12 ,, | 1 1 0 |
| 13052 | 16 ,, | 16 ,, 13 ,, | 18 ,, | 1 1 0 |
| 5601 | 16 ,, | 16 ,, 14 ,, | 15 ,, | 1 1 0 |
| 6827 | 16 ,, | 16 ,, 14 ,, | 17 ,, | 1 1 0 |
| 4494 | 16 ,, | 16 ,, 14 ,, | 14 ,, | 1 1 0 |
| 3548 | 16 ,, | 16 ,, 15 ,, | 12½ ,, | 1 1 0 |
| 6677 | 16 ,, | 16½ ,, 13½ ,, | 12½ ,, | 1 1 0 |
| 9645 | 16 ,, | 16½ ,, 13½ ,, | 12½ ,, | 1 1 0 |
| 4434 | 16 ,, | 17⅝ ,, 14 ,, | 14 ,, | 1 1 0 |
| 6469 | 16 ,, | 18 ,, 14 ,, | 15 ,, | 1 1 0 |
| 9015 | 16 ,, | 18 ,, 14 ,, | 18½ ,, | 1 1 0 |
| 4327 | 16 ,, | 18 ,, 15 ,, | 15½ or 19 ,, | 1 1 0 |
| 8049A | 16 ,, | 18 ,, 15 ,, | 17⅞ ,, | 1 1 0 |
| 6137 | 16 ,, | 20½ ,, 13½ ,, | 13½ ,, | 1 1 0 |
| 5918 | 17 ,, | 18 ,, 14 ,, | 14 or 17 ,, | 1 3 0 |
| 5053 | 17 ,, | 19⅝ ,, 12 ,, | 14½ ,, | 1 3 0 |
| 7548 | 17 ,, | 20 ,, 13 ,, | 15 ,, | 1 3 0 |
| 6468 | 17 ,, | 20 ,, 16 ,, | 15½ ,, | 1 3 0 |
| 4316B | 17 ,, | 21 ,, 14 ,, | 14 ,, | 1 3 0 |
| 7975 | 17 ,, | 21 ,, 15 ,, | 14½ ,, | 1 3 0 |
| 13459 | 17 ,, | 21½ ,, 13½ ,, | 15 ,, | 1 3 0 |
| 14284 | 18 ,, | 18 ,, 13½ ,, | 19 ,, | 1 5 0 |
| 12990 | 18 ,, | 18 ,, 15 ,, | 15 or 19 ,, | 1 5 0 |
| 7135 | 18 ,, | 18⅝ ,, 15 ,, | 13 ,, | 1 5 0 |
| 10221 | 18 ,, | 18 ,, 16 ,, | 13⅝ ,, | 1 5 0 |
| 4506 | 18 ,, | 20 ,, 13 ,, | 19½ ,, | 1 5 0 |
| 6470 | 18 ,, | 20 ,, 13 ,, | 15 ,, | 1 5 0 |
| 6818 | 18 ,, | 20 ,, 13½ ,, | 17½ ,, | 1 5 0 |
| 13998 | 18 ,, | 20 ,, 14 ,, | 19½ ,, | 1 5 0 |
| 4083 | 18 ,, | 20 ,, 15 ,, | 16 ,, | 1 5 0 |
| 5306 | 18 ,, | 20½ ,, 14 ,, | 15½ ,, | 1 5 0 |
| 13295 | 18 ,, | 20½ ,, 14 ,, | 19½ ,, | 1 5 0 |
| 7356 | 18 ,, | 20½ ,, 13½ ,, | 13 ,, | 1 5 0 |
| 4569 | 18 ,, | 21 ,, 14 ,, | 18 ,, | 1 5 0 |
| 3628 | 18 ,, | 21 ,, 15 ,, | 16 ,, | 1 5 0 |
| 13999 | 18 ,, | 22 ,, 14 ,, | 19½ ,, | 1 5 0 |
| 7640 | 18 ,, | 22 ,, 13½ ,, | 18½ ,, | 1 5 0 |
| 14250 | 19 ,, | 19 ,, 14 ,, | 19 ,, | 1 8 6 |
| 14286 | 19 ,, | 20 ,, 13½ ,, | 20 ,, | 1 8 6 |
| 7971A | 20 ,, | 20 ,, 15 ,, | 18 ,, | 1 11 0 |
| 14285 | 20 ,, | 21 ,, 13½ ,, | 19 ,, | 1 11 0 |

### Mouthpieces with Circular Lids for Oval Retorts.

| Pattern No. | Diam. Mouth. | Internal Dimensions of Retort. | Length of Mouthpieces. | Lid and Fittings without Mouthpiece. |
|---|---|---|---|---|
| 13658 | 14 ins. | 14 × 12 ins. | 15 ins. | £0 19 0 |
| 4356 | 14 ,, | 18½ ,, 12 ,, | 12½ ,, | 0 19 0 |
| 6851 | 15 ,, | 16 ,, 14 ,, | 13 ,, | 1 0 0 |
| 3629 | 15 ,, | 18½ ,, 13½ ,, | 14 ,, | 1 0 0 |
| 3580 | 15 ,, | 21 ,, 15 ,, | 15 ,, | 1 0 0 |
| 6264 | 16 ,, | 18½ ,, 15½ ,, | 15⅝ ,, | 1 1 0 |
| 5210 | 16 ,, | 20 ,, 14 ,, | 15 ,, | 1 1 0 |
| 6263 | 16 ,, | 24 ,, 16 ,, | 13½ ,, | 1 1 0 |
| 5370 | 17 ,, | 20 ,, 14 ,, | 14 ,, | 1 3 0 |
| 6832 | 17 ,, | 20 ,, 14 ,, | 17 ,, | 1 3 0 |
| 6183 | 17 ,, | 20 ,, 15 ,, | 15 ,, | 1 3 0 |
| 4289 | 17 ,, | 21 ,, 15 ,, | 14 ,, | 1 3 0 |
| 5270 | 17 ,, | 22 ,, 14 ,, | 14 ,, | 1 3 0 |
| 3631 | 18 ,, | 18 ,, 14 ,, | 20 ,, | 1 5 0 |
| 3681 | 18 ,, | 21 ,, 14 ,, | 13½ or 15 ,, | 1 5 0 |
| 3554 | 18 ,, | 21 ,, 15 ,, | 14¾ ,, | 1 5 0 |
| 7957 | 18 ,, | 22 ,, 16 ,, | 14 ,, | 1 5 0 |
| 8048A | 19 ,, | 25½ ,, 15 ,, | 18 ,, | 1 8 6 |

### Mouthpieces with Oval Lids for Oval Retorts.

| Pattern No. | Dimensions of Mouth. | Internal Dimensions of Retort. | Length of Mouthpiece. | Lid and Fittings without Mouthpiece. |
|---|---|---|---|---|
| 9800 | 18 × 14½ ins. | 18 × 14⅞ ins. | 15 ins. | £1 5 0 |
| 9205 | 20 ,, 12 ,, | 24 ,, 14 ,, | 10¾ ,, | 1 10 0 |
| 10000 | 20½ ,, 14½ ,, | 23½ ,, 14½ ,, | 16 ,, | 1 10 0 |
| 9680 | 21 ,, 15 ,, | 21 ,, 15 ,, | 15 ,, | 1 12 0 |
| 10056 | 21 ,, 14½ ,, | 21 ,, 14½ ,, | 15⅝ ,, | 1 12 0 |
| 13218 | 21 ,, 15 ,, | 21 ,, 15 ,, | 17 ,, | 1 12 0 |
| 10514 | 23½ ,, 13⅝ ,, | 23½ ,, 13⅝ ,, | 13⅝ ,, | 1 13 0 |
| 13766 | 20 ,, 17 ,, | 20 ,, 17 ,, | 15½ ,, | 1 15 0 |
| 13289 | 24 ,, 15 ,, | 24 ,, 15 ,, | 18 ,, | 1 18 0 |
| 13884 | 24 ,, 15 ,, | 24 ,, 15 ,, | 10 ,, | 1 18 0 |

### Mouthpieces with D Lids for D Retorts.

| Pattern No. | Dimensions of Mouth. | Internal Dimension of Retort. | Length of Mouthpiece. | Lid and Fittings without Mouthpiece. |
|---|---|---|---|---|
| 12292 | 15½ × 13 ins. | 15½ × 13 ins. | 12 ins. | £1 2 0 |
| 9967 | 16 ,, 14 ,, | 16 ,, 14 ,, | 15½ ,, | 1 3 0 |
| 13574 | 16⅝ ,, 13⅝ ,, | 16⅝ ,, 13⅝ ,, | 12½ ,, | 1 4 0 |
| 9899 | 18 ,, 12 ,, | 18 ,, 12 ,, | 14 ,, | 1 4 0 |
| 12980 | 16 ,, 16 ,, | 16 ,, 16 ,, | 18 ,, | 1 6 0 |
| 13900 | 18 ,, 13⅝ ,, | 18 ,, 13 ,, | 15 ,, | 1 6 0 |
| 9912 | 18 ,, 13½ ,, | 18 ,, 13½ ,, | 17 ,, | 1 6 0 |
| 9962 | 18 ,, 12½ ,, | 18 ,, 12½ ,, | 16 ,, | 1 6 0 |
| 10982 | 18 ,, 13½ ,, | 18 ,, 14 ,, | 15 ,, | 1 6 0 |
| 11096 | 18 ,, 14 ,, | 18 ,, 14 ,, | 13 ,, | 1 6 0 |
| 9492 | 20 ,, 13 ,, | 20 ,, 13 ,, | 15 ,, | 1 10 0 |
| 9208 | 20 ,, 13 ,, | 20 ,, 13 ,, | 19½ ,, | 1 10 0 |
| 10251 | 20 ,, 13 ,, | 20 ,, 13 ,, | 15⅝ ,, | 1 10 0 |
| 12964 | 20 ,, 13 ,, | 20 ,, 13 ,, | 13½ ,, | 1 10 0 |
| 9909 | 20 ,, 13⅝ ,, | 20 ,, 13⅝ ,, | 17 ,, | 1 10 0 |
| 12969 | 19½ ,, 15½ ,, | 19½ ,, 15½ ,, | 14 ,, | 1 11 0 |
| 13781 | 20 ,, 15 ,, Front. / 21 ,, 15 ,, Back. | 21 ,, 15 ,, | 15 ,, | 1 11 0 |
| 14287 | 20½ ,, 14⅞ ,, | 20½ ,, 4⅞ ,, | 17 ,, | 1 11 0 |
| 7692 | 21 ,, 15½ ,, | 21 ,, 15½ ,, | 16 ,, | 1 11 0 |
| 12978 | 20 ,, 16 ,, | 20 ,, 16 ,, | 17 ,, | 1 11 0 |
| 13252 | 20 ,, 16 ,, | 20 ,, 16 ,, | 18 ,, | 1 11 0 |
| 13220 | 21 ,, 15 ,, | 21 ,, 15 ,, | 17 ,, | 1 11 0 |
| 13992 | 21 ,, 16 ,, | 21 ,, 16 ,, | 17 ,, | 1 11 0 |
| 8977 | 21½ ,, 13⅝ ,, | 21½ ,, 13⅝ ,, | 18⅝ ,, | 1 12 0 |
| 8976 | 21½ ,, 13⅝ ,, | 21½ ,, 13⅝ ,, | 18⅝ ,, | 1 12 0 |
| 10497 | 21½ ,, 13⅝ ,, | 21 ,, 13⅝ ,, | 18⅝ ,, | 1 12 0 |
| 8037 | 21½ ,, 13½ ,, | 21½ ,, 13½ ,, | 18½ ,, | 1 12 0 |
| 9908 | 21½ ,, 15½ ,, | 21½ ,, 13½ ,, | 15 ,, | 1 12 0 |
| 10404 | 21½ ,, 13½ ,, | 22 ,, 14 ,, | 18½ ,, | 1 12 0 |
| 12410 | 21½ ,, 13½ ,, | 23 ,, 14 ,, | 12 ,, | 1 12 0 |
| 13822 | 21½ ,, 13½ ,, | 22 ,, 14 ,, | 15 ,, | 1 12 0 |
| 10515 | 23½ ,, 12⅝ ,, | 23½ ,, 13⅝ ,, | 13½ ,, | 1 12 0 |
| 7924 | 24 ,, 14 ,, | 24 ,, 14 ,, | 15⅝ ,, | 1 13 0 |
| 13807 | 24 ,, 15½ ,, | 24 ,, 15½ ,, | 16 ,, | 1 14 0 |
| 9015B | 25 ,, 14 ,, | 25 ,, 14 ,, | 19½ ,, | 1 14 0 |
| 10932 | 25 ,, 14 ,, | 24 ,, 14 ,, | 13½ ,, | 1 15 0 |
| 12944B | 22 ,, 16 ,, | 22 ,, 16 ,, | 16 ,, | 1 15 0 |
| 14037 | 22 ,, 16 ,, | 2 ,, 16 ,, | 16 ,, | 1 15 0 |
| 14119 | 22 ,, 16 ,, | 22 ,, 16 ,, | 18 ,, | 1 15 0 |

Patterns marked A have Sockets at back to connect to Retorts; all the others are flanged. | Patterns marked B have curved bottoms.

*Telegrams:* "*TANGYES BIRMINGHAM.*"

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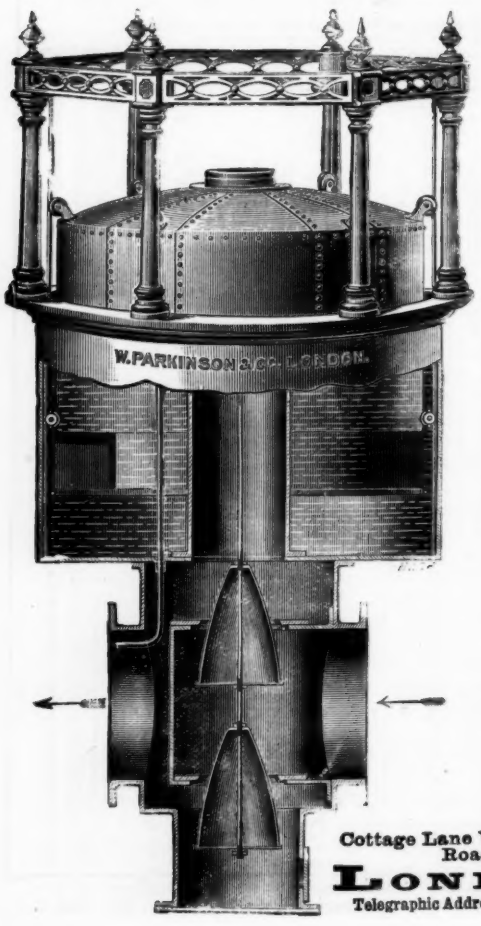


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THE

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## WATER SUPPLY, & SANITARY IMPROVEMENT.

*TUESDAY, APRIL 14, 1891.*


### Last Year's Accounts of the London Gas Companies.

WITH the present issue of the JOURNAL appears the customary comparative statement of the accounts of the London Gas Companies for the past year, which gives a complete synopsis of the financial position of all these undertakings, as well as a concise indication of the cost and profit of supplying gas to London as a whole. It is often observed that Nature abhors precise measurements; and it is equally true that London is unsusceptible of exact statistical expression. There are many different Londons; and the London of the three Metropolitan Gas Companies is not the least peculiar in its delimitations—excluding many districts that are included in other categories of Metropolitan affairs, and elsewhere going far outside the conventional boundaries of the capital. The effect of this want of correspondence between the London of the Gas Companies and that (say) of the Registrar-General, renders it idle to attempt to collate the data relating to gas supply with those of population. It could be done, perhaps, by taking out the parishes separately; and if anything like an approximation to truth were arrived at in this way, it would be possible to form an idea as to the popularity of gas with Metropolitan householders. There is reason to believe that the consumption of gas per head of the population runs higher in London than anywhere else; but there is little exactitude in the computation. Our table shows one striking fact—that £15,121,851 is invested in the gas supply of London, which is an increase of £770,955 for the year. By far the lion's share of the increase, or £671,600, was absorbed by the Chartered Company. The total income earned upon this investment was £4,780,641, out of which no less than £3,837,302 went to meet expenses, leaving a gross profit of £943,339, which works out to £6 4s. 9d. per cent. on the capital and borrowed money. It is as well to draw special attention to this latter figure. It has been said by some people who do, and by others who do not, know better, that the business of gas supply is a mine of wealth, especially in London. At the time when labour troubles loomed most formidably on the Metropolitan horizon, the rates of dividend declared by the Gas Companies were cited to prove that the Companies could pay anything they liked for labour. Doubtless very many keen gentlemen engaged in the coal trade thought the same with regard to the prices that could, by any ingenuity, be obtained for gas coal. It must, however, be obvious enough, without need of argument or explanation, that an industry which only makes a gross profit of £6 9s. 9d. per cent. upon the capital employed in it has no such unlimited length of tether. "Just so," say some well-meaning persons; "then advertise the fact "by adjusting the nominal amount of capital to such a "figure as shall, by its very denomination of 5 or 6 per "cent. stock, show the most ignorant caviller how much "it really earns." But, with all respect for the motive that inspires the suggestion, we cannot see our way to support it. It would be practically impossible to preserve any trustworthy approximation between the nominal and real returns upon a given stock; and the preliminary operation of increasing the nominal amount of the investment has an ugly look. As matters stand, the rating of the different orders of share and loan gas capital is the result of natural causes; and a simple computation, such as that under notice, establishes not a merely approximate, but an absolutely exact, figure for the profit earnings of a particular undertaking or group of undertakings.

The people of London paid last year £3,146,319 for gas sold by meter; and through their local governing bodies, £216,054 for street and public lighting generally. These are figures that naturally make the mouths of electricians water; but the fact that they are respectively £196,095 and £5625 higher than those applying to the previous year, may be taken as an indication that no serious inroad has yet been made by any other system of lighting upon the empire of gas. The increase of meter and stove rental by £10,448 for the year, is further evidence on the same side. The fact of residuals having gone up by £157,589—which did so much to make up for the increased working expenses—is, of course, largely to be attributed to the early severity of the winter. The improvement of residuals, however, did not go far enough; for coals alone cost £471,994 more than they did the year before; wages jumped up £85,994; and wear and tear was responsible for £76,072 more in manufacture alone. Indeed, with but trifling exceptions, all the heads of expenditure showed heavy increases; so that while the Companies managed to get in £372,318 more money, they had to spend £702,398 more in the effort—thus reducing their gross profit by £330,080, compared with the previous year. It is curious to compare the circumstances of the Companies whose

aggregate returns work out to these figures. Thus the Chartered increase of revenue was (in round numbers) twelve times that of the Commercial, and nearly thrice that of the South Metropolitan; their increase of expenditure was fifteen times that of the Commercial, and four times that of the South Metropolitan.

The greatest share of critical interest attaches to the table in which the totals of the accounts are reduced to the engineer's standard of the ton of coal carbonized. The average capital burden for all the Companies was £5 7s. 11·44d.—only a small advance on the average for the preceding year. This is due solely to the Chartered Company, who have increased from £5 13s. 11·96d. to £5 16s. 3·30d. The South Metropolitan Company dropped from £4 14s. 8·56d. to £4 12s. 6·20d.; while the Commercial Company (by overdrawing the account) got it down to £3 17s. 3·73d. The average gas-rental was £1 4s. 0·04d. per ton; and residuals returned 9s. 3·95d. per ton. Altogether, the average total revenue rose from £1 12s. 11·12d. to £1 14s. 1·54d. per ton of coal carbonized. On the other hand, the expenditure was increased from £1 3s. 4·98d. to £1 7s. 4·73d. Coals cost 14s. 8·91d. as compared with 11s. 10·80d., although the dues had been removed; and wages (carbonizing) went up from 3s. 4·23d. to 3s. 9·82d. Wear and tear rose to 3s. 1·36d. per ton. The charge for bad debts and extraordinary expenses was but slightly diminished, working out to 6·95d. per ton. The small charge of 1·05d. per ton of coal carbonized pays for all the Directors and Auditors, who do not seem dear at this rate, though in the total it attains the respectable amount of £12,275. In the uneconomical old times, before taxation and finance had become systematic, a monarch of the breed that was prone to be generous with other people's money would grant a favourite a toll on some article of consumption within a stated district. Insignificant as it would appear at first sight, a penny toll on every ton of coal made into gas in London would now be a handsome allowance for anybody. This consideration throws some light upon the incidence of the defunct coal-tax, to which at least two of the Chairmen of London Gas Companies were no very fervent objectors. Now the load is gone, what, we wonder, would Col. Makins, M.P., and Mr. Gill say to a proposal to put it back again for the current year?

It only now remains to notice the details of the carbonizing work of the three Companies, which are set forth in the following table :—

TABLE *of the Residuals and Gas made, per Ton of Coals carbonized, by the Metropolitan Companies in the Year* 1890.

| Name of Company. | Coke per Ton of Coals, in Bushels. | Breeze per Ton of Coals, in Bushels. | Tar per Ton of Coals, in Gallons. | Ammoniacal Liquor per Ton of Coals, in Gallons. | Gas Made, Cub. Ft. per Ton. |
|---|---|---|---|---|---|
| CHARTERED . . . | 46·36* | 3·32* | 10·93 | 31·11 | 10,203 |
| COMMERCIAL . . . | 47·19 | 4·05 | 9·74 | 36·78 | 9,920 |
| SOUTH METROPOLITAN | 49·46 | 3·79 | 9·79 | 33·50 | 9,889 |
| Mean per Ton . . | 47·13 | 3·48 | 10·59 | 32·08 | 10,110 |

* The returns of coke and breeze are given in *tons*. These have been reduced to bushels on the Company's basis of 9½ cwt. of coke to the chaldron, and 50 bushels of breeze to the ton.

Here may be seen the results of the retort-house performances of the Companies, reduced to a uniform standard. In connection with this matter, however, we desire to draw attention to the inconvenience and difficulty consequent upon the diversity of the fashions followed by the different Companies in making their returns of residuals. The Chartered state both coke and breeze in tons; the South Metropolitan state coke in hundredweights and breeze in yards; the Commercial give both coke and breeze in chaldrons. Surely, there can be no sufficient reason for this confusion between weights and measures. It appears that the Chartered plan is much the simplest. Returning, after this digression to the matter of the table, it will be seen that the average rate of gas production was 10,110 cubic feet per ton, which compares unfavourably with the 10,245 cubic feet for 1889. All the Companies fell off—the Chartered from 10,334 to 10,203 cubic feet per ton; the Commercial from 10,125 to 9920 feet; and the South Metropolitan from 10,010 to 9889 feet. So that, crudely expressed, the Companies' carbonizing work might be summarized by saying that they paid more for their coal and got less out of it. Beyond this, the relative practice of the Companies was preserved as in former years. Not much alteration of these ratios is to be looked for. It should be remarked (because it does not appear on the surface of our statistics) that, although the carbonizing work of the Companies did not turn out quite so well last year, it represents a considerably increased consumption of cannel and liquid hydrocarbon. And as last year's figures were, in regard to gas production, considerably worse than those for the year before, it cannot be said that London carbonization is improving much as time goes on. What may be the reason for this would take too long to inquire just now; and consequently we prefer to recommend our critical readers to draw their own conclusions on the facts we have supplied.

### The Royal Commission on Labour.

THE announcement that Mr. George Livesey has been placed upon the Royal Commission on Labour will be received with much satisfaction, not only by members of the profession of gas engineering and management, but also by the wider section of the public which has the interest of Freedom of Labour at heart. It will, of course, be greeted with a howl of denunciation from certain shady corners—notably from the places where wire-pullers of the New Unionism most do congregate. The Commission is so comprehensive, however, that it would have been a distinct oversight if Mr. Livesey's name had been omitted from it. The cause of Associated Labour will not suffer in the hands of its representatives on the Commission, although neither Mr. Michael Davitt nor Mr. John Burns has been selected for this distinction. The most rabid Unionist, who would describe every man who has been an accredited spokesman of Labour for more than three years as fossilized, cannot but admit that Mr. Tom Mann, Mr. Tait, and Mr. Austin are fresh enough to serve as types of the Unionist for the period of the Commission's existence. Of course, the composition of the Commission does not please everybody. Some say it is too big, which is a fair criticism; but, on the other hand, if it had been smaller there would have been a huge outcry from excluded interests. The terms of the reference are wide enough. The Commission is "to inquire "into and report upon questions affecting the relations "between employers and employed, the combinations of "employers and employed, and the conditions of labour, "which have been raised during the recent trade disputes "in the United Kingdom; and to report whether legisla-"tion can with advantage be directed to the remedy "of any evils that may be disclosed, and, if so, in what "manner." The names of the Commissioners have already been sharply canvassed in the newspapers; and their owners have been catalogued by various critics according to classifications suggested by their predilections. Thus, the *Daily Chronicle* puts Mr. Livesey among the "capitalists," and further classifies him with Sir W. T. Lewis as "of a non-sympathetic type; both of them having "been engaged in recent and bitter struggles with the New "Unionism." Why the experience of the particular section of labourers who have set up what is known as New Unionism should be taken as the test of the sympathy of employers with workers in general, we fail to see. Mr. Livesey we know—and the same may, for all that appears to the contrary, be said of Sir W. T. Lewis—has been a devoted friend of the working classes all his life long; but he is, of course, antipathetic to those "working men" who prefer "organizing" to working.

The spirit that calls Mr. Livesey "unsympathetic" to the cause of Labour because he has been altogether too strong for the wire-pullers of the New Unionism is the same that raises the lament over the fate of the foiled and discredited leader of the Seamen's and Firemen's Union, who was sentenced at the Cardiff March Sessions last week to six weeks' imprisonment for "unlawful assembly" in connection with the recent strike at that port. What Wilson did on this occasion to bring himself within the grasp of the law cannot be denied even by his friends. He led a raid upon a boarding-house, and molested non-Unionists. The lesson of keeping within the four corners of the law is a difficult one for New Unionists to learn; but they will acquire it in time, just as the Old Unionists, who were once new, have had to do as the condition of existence. Those who complain that a New Unionist leader gets punished like anybody else if he is convicted of breaking the law, must ask themselves whether these gentry would be likely to fare better in a lawless land. The question admits of a simple

expression. If a mining company undertake to carry on operations in England, they confide in the common law; but if the scene of their operations is in such a locality as Pennsylvania, they engage their own guards. The New Unionist contention that any foolish or violent person must be allowed to do everything he pleases, so long as it is in the supposed interests of Unionism, will recoil upon those who support it. Men like Wilson are the worst enemies to the cause they profess. Empty demagogues like John Burns, who invite those silly enough to listen to them to take risks which they carefully avoid for themselves, must fall in the end before the accumulated resentment of their deluded victims. Men who deliberately attempt to advance a weak cause by violent means must be dealt with summarily, however; and while it will do him no harm personally, Wilson's sentence may be expected to bear a good lesson even for those who raise the loudest outcry against it.

**The Institution of Gas Engineers Preparing for Action.**

THE Council of the Incorporated Institution of Gas Engineers met last Saturday week, and, we understand, practically settled the programme of the forthcoming May meeting, at which the President (Mr. G. C. Trewby) will deliver his Inaugural Address. There will be an autumn meeting, probably in September. A promising list of papers has been brought together for the first meeting; and no effort will be spared to secure instructive discussion of the matters to be submitted to the Institution. A description of the labour-saving carbonizing plant at Kensal Green is to be given by Mr. A. M'Minn, Engineer of that station of the Chartered Company; and it is hoped that this paper will raise the general question of inclined retort working and coal handling by machinery. Mr. Charles Hunt, of Birmingham, will treat of gas purification, with special reference to the influence of various methods of purifier working upon illuminating power. Professor Vivian B. Lewes will communicate the particulars of his recent work upon the examination of the products of combustion of gas-flames; thus following up his valuable Society of Chemical Industry paper, an abstract of which appears elsewhere. The subject of water gas ought to be sufficiently expounded by Mr. Goulden, of Beckton, and by Mr. Glasgow, who will treat of American practice. Mr. A. Colson, of Leicester, will contribute a constructional paper, containing a description of his Aylestone Road works extensions, which will give a good opportunity for a general debate upon the principles of gas-works enlargement. It must be conceded that this is a very attractive showing for the new Institution, especially when it is considered that some of the most important subjects, such as carbonizing economies and water-gas experiments, will be open to the inspection of gas engineering visitors to London next month. A prominent feature of the meeting will be a dinner, at which it is hoped that a numerous and influential company will assemble to wish long life and prosperity to the young organization. It should be mentioned that the Council have secured as Secretary Mr. Thomas Cole, of No. 11, Victoria Street, S.W.—already favourably known as Secretary of the Association of Municipal and Sanitary Engineers and Surveyors.

**The Gas Workers' Union and the East Greenwich Stokers.**

THE press organs of the New Unionism have at last got a piece of news, of which they are naturally making the very most in their power. It may appear to our readers, and readers of the newspapers, that there ought not to be any lack of matter for Labour journals; but it so happens that these curious productions are managed on the principle of ignoring bad news. The moment a strike is seen to be going wrong, all mention of it is dropped, because to dwell upon the misery of workers who have lost their all by blindly following the counsels of the demagogues would not be complimentary to the latter. Like the sporting prophets to whom we have on previous occasions compared them, Union wire-pullers prefer to confine their discourses to much safer topics than their own failures. They are now all agog because at the East Greenwich station of the South Metropolitan Company a notice has been posted inviting eight-hour stokers to work two shifts, at a corresponding advance of pay. The circumstances are, as we understand, that at this station the scoop men only have been divided into three shifts; the firemen and other hands having worked in two shifts all along. This dual arrangement has proved awkward to manage; and now that the season has come for reducing the gangs, it was decided to return to the uniformity of the two shifts for all hands. Of course, there is no compulsion in the matter. Those winter hands who do not like two shifts need not apply to be reinstated next autumn; while those who prefer putting in good time at the gas-works to abandoning themselves to the delights of East Greenwich for 16 hours out of the 24 will be correspondingly benefited. The characteristic comment by Mr. W. H. Ward, the Assistant-Secretary of the Union, upon this alteration is that "Mr. Livesey "means to recoup his Company for the tremendous waste "of money made by them at the time of the strike." It requires an Irish intellect to follow this reasoning. Instead of paying scoop drivers 5s. 7d. and front men 5s. 4d. per shift of eight hours and 80 retorts, they are offered 6s. 9d. and 6s. 6d. per twelve-hour shift of 100 retorts. Formerly, the work of a shift was 90 retorts for 5s. 6d. At the new rate, the same quantity of work will cost the Company rather more that 6s. How the Company are to save money by this advance is anything but clear. It may be supposed that, in raising the task per shift to 100 retorts, the circumstances have been duly considered. At the three-shift rate of ten retorts per hour, it is only work for ten hours, and the extra payment is computed as fairly as possible, avoiding fractions. The *Trade Unionist* thinks that the South Metropolitan shareholders are "angry" because the Directors will not raise the price of gas—and thereby lower the statutory rate of dividend. The Unionist view is, or is stated to be, that Mr. Livesey would raise the price of gas at once were he not afraid that all his men would strike against the consequent reduction of what the same critics dearly love to call the "bogus bonus scheme." It is to be feared that there is much more "bogus" in connection with the funds of the Gas Workers' Union than there is in the solid cash balances owned by the South Metropolitan workmen. Ward seems to be flattering himself that some of the men will strike against having to take 6s. 9d. and 6s. 7d. for ten hours' work, instead of 5s. 7d. and 5s. 4d. for eight hours; but he is not likely to have the pleasure of making the present race of stokers throw up their good bread and butter as the others did, to their lasting sorrow. He thinks this would be an "amusing" result; but the men would find it something different. With regard to the effect of a possible rise in the price of gas in South London upon the workmen's bonuses, there is reason for stating that the fact of a London Gas Company who do not pay a profit-share to their workmen having been already compelled to take this step has not been lost sight of by the South Metropolitan men; and they are so well disposed in regard to the matter, that if anything could mitigate Mr. Livesey's reluctance to increase the price of gas, it would be the evidence that such a course would supply of the complete accord which exists between the Directors and their working staff. Up to the present, however, the only dearer gas sold in London is made by Union hands, which is a patent fact worth all the stale abuse of the fresh South Metropolitan workers by demagogues who cannot make anything out of them.

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**Presentation to Mr. A. Dickson.**—The officials of the Kent Water-Works Company, comprising the Secretary's and Engineer's departments, taking advantage of the opportunity afforded by the occurrence of the "silver wedding" of Mr. Alexander Dickson, Secretary, recently presented to that gentleman a silver bowl, handsomely mounted, in testimony of their regard and esteem for him, and their appreciation of the manner in which he has for so many years discharged the duties of his office. They accompanied the gift with an expression of their wish that he and Mrs. Dickson might enjoy long life, and see the arrival of their "golden wedding" in peace and happiness.

**Dissolution of the Belgian Gas Company for the Supply of Rio de Janeiro.**—According to a paragraph which appears in a French contemporary, the Belgian Company formed a few years ago to work the concession for supplying gas in Rio de Janeiro is to be dissolved, and the concern taken over by the Bank of Paris and Rio. It seems that the shareholders are to be paid a sum of 50 millions in specie—one-fourth of the amount at the time of the transfer, and the remainder in monthly instalments. Holders of bonds of the first issue will receive 575 frs. per 500 fr. bond, *plus* interest at the rate of 6 per cent. up to the day of redemption; holders of bonds of the second issue will be paid off at par, *plus* 5 per cent. interest; preference shareholders will have 750 frs. for each 500 fr. share, *plus* interest at 8 per cent.; and the ordinary shareholders will divide what is left after the expenses of liquidation have been met.

## WATER AND SANITARY AFFAIRS.

THE statement that the Metropolitan Water Companies have revoked their decision to be represented as one body before the Parliamentary Committee on the London Water Bills, and have resolved to defend their interests as separate and distinct Companies, is subject to some modification. Our information is to the effect that the Companies are associated for mutual defence so far as their interests are in common, but are prepared to act separately where distinct and separate interests are involved. It is obvious that the position of the Companies taking their supply from the Thames differs in some respects from that of the New River Company, the Kent, or the East London. In the course of the inquiry before the Committee, questions may be raised affecting certain Companies specially, and requiring, therefore, a particular line of defence. At the same time, there are important points concerning which the Companies are so similarly situated, that separate representation would be absurd. At the outset it was thought that one petition would be sufficient for all the Companies. The subsequent resolution to petition separately was due to the fear that certain questions affecting particular Companies might otherwise be quite shut out. It is apprehended that the Thames Companies will be specially attacked as abstracting too much water from the stream. If any weight is attached to this contention, a practical answer will be forthcoming. The turbid character of the water supply on some recent occasions can also be satisfactorily accounted for. Among the witnesses on the side of the Companies will be Sir Frederick Bramwell, Dr. C. Meymott Tidy, Mr. T. Hawksley, and Mr. Mansergh. As for the duration of the inquiry, that is at present a mere matter of conjecture. Unless the Meter Bill drops on one side, as many as seven Bills, including the County Council Bill lately introduced by Sir John Lubbock, will require the attention of the Committee. The Metropolis Water Supply Bill, emanating from the various Vestries and District Boards, is that which has the most direct and immediate bearing on the main question. This proposes that the existing undertakings shall be purchased by a Water Trust, or by the County Council, on notice given by one of these bodies, within two years after the passing of the Act. In case of disagreement, the terms are to be settled by arbitration. The London Water Commission Bill of the Corporation is looked upon as a shadowy kind of measure, of little value in the present aspect of affairs. Sir John Lubbock's Bill, giving the County Council power to initiate legislation in reference to the water supply, would, if passed, be fraught with important consequences later on. It is to be remembered that the Metropolis Water Supply Bill is not acceptable to the County Council, as represented by their Parliamentary Committee. The objection lies chiefly against the purchasing clauses.

It would be expecting too much to suppose that Mr. Archibald Dobbs could long remain silent while the water supply question is becoming daily more prominent. In a lengthy letter to *The Times* last week, this gentleman recounted the powers possessed by the London Water Companies, with an intimation that, in a second letter, he would show wherein these powers had been exceeded. So far as the first letter goes, Mr. Dobbs seems to prove that the Companies have kept within their powers, and that, if fault rests anywhere, it is with Parliament rather than with the Companies. He complains as to the inequalities of the water-rates, and shows that a large house of £800 annual value, having five water-closets, two fixed baths, and supplied with water on every floor, would pay nearly twice as much for water if situated in the East London district as it would in the district of the New River, Chelsea, West Middlesex, or Grand Junction Company. Mr. Dobbs may prove this to his heart's content; but how many £800 houses does he find in the East London district? Does he find one? For small houses he shows that in Lambeth the water-rate is more than twice as heavy as in the wealthier districts. This simply represents the fact that where there are big houses they help to pay for the little ones; and where there are no big houses, the little ones have to pay for themselves. The East London Company, as will be seen by our report of their recent half-yearly meeting, have paid, on an average, only 5½ per cent. dividend since the date of incorporation, and have only just reached 8 per cent. for the second time in 38 years. We commend to the earnest attention of Mr. Dobbs and other critics, the account given by the Company's Engineer (Mr. W. B. Bryan, M. Inst. C.E.) of the exertions put forth by the Company's staff, in order to maintain the supply during the terrible frost of the past winter. A large expense was also incurred in providing the enormous extra supply of water necessary to compensate for the waste occasioned by "many "thousands of burst lead pipes." In like manner, a little attention may be profitably bestowed on the account given by the Chairman (Mr. Gadesden) of the works undergoing completion for the enlargement and improvement of the supply in the East London district, by means of deep wells and increased engine power.

## ESSAYS, COMMENTARIES, AND REVIEWS.

### GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 711.)

THE past week opened with the tendency to dulness which marked the close of its predecessor; but, as it progressed it gave signs of a disposition to improve, though much solid, foundation for such a turn is not at once apparent. The considerable improvement made in the American railway market rested upon the solid foundation of better business and more amicable inter-relations; and this produced a better feeling in other markets. Argentines have been much more cheerful; though we fail to see a great deal to justify this, beyond what is very speculative and sentimental. The price of gold is notoriously worked up and down by a gang of unprincipled harpies; and reported quotations should be received with great caution. But it is no use telling a drowning man not to clutch at a straw. The Money Market is much firmer. Gas continues to improve in public favour; and again it may be noted that the Metropolitan Companies are the foremost to advance. The market was tolerably active at first; but after the close of the account, business became much quieter. Gaslight opened well; and the last transaction on Monday was marked at 244. This figure was not touched again; but the stock remained very firm to the close of the week. The debenture and 10 per cent. preferences realized very good prices—especially the former; but only the latter advanced their quotation. The "H" was offered on easier terms, and fell 1. South Metropolitan continued in good demand, but were only moderately dealt in. The "A" and "C" have advanced, and the "B" marked top price. Commercials have made considerable improvement—especially the old stock; the *ex div.* quotation being nearly 5 per cent. higher. The Suburban and Provincial undertakings have not furnished much business; and the only change is the easier quotation of Alliance and Dublin new. The Continental Companies have been rather quiet; but they show marked firmness, with the small exception of Ottoman, which has had a 10 per cent. drop. Of the South American division, Monte Video is firm at an advance of ½; but Bahia is down again, with business marked at 13. The Water Companies were heavily depressed; and all have receded in value from 2 to 5½ per cent.

The daily operations were: The Gas Market opened well on Monday. Business was active, and everything was as firm as a rock. Commercial old rose 2; Gaslight "A," 1; and Monte Video, ½. Water was hardly noticed. Gas was a little quieter on Tuesday; but prices continued very good. South Metropolitan "A" rose 2; ditto, "C," 2½; Gaslight "C," "D," and "E," 1; and ditto, "J," 2. The "H," however, receded 1. The fall in Water began. East London, Southwark, and West Middlesex fell 2½; Grand Junction and New River, 2; and Chelsea, ½. On Wednesday, the Gas Market remained as the day before; and Water had no further fall. Transactions in Gas were much more limited on Thursday. Prices continued very firm, with the exception of a drop of 1 in Bahia. Water was weaker. Kent fell 5; and Southwark "D," 3. On Friday, Gas was again very quiet but firm. Imperial Continental advanced 1. Water showed further depression by a fall of 5 in Chelsea, and 2 in Lambeth; but the *ex div.* quotation of East London was rather better. On Saturday, Gas was firm and unchanged. Water also closed without further variation.

### ELECTRIC LIGHTING MEMORANDA.

**A Proposed Electric Lighting Scheme for Hampstead—A Mistaken Deduction—Gas and Electricity Meters—Objection to Arc Lamps.**

THE Hampstead Vestry have had the subject of electric lighting under their consideration, and not long ago commissioned Mr. W. H. Preece, F.R.S., to report upon the practicability of providing a public electric lighting establishment in the parish. This kind of consulting work, by the way, of which the Electrician to the Post Office has almost a monopoly, must be a very profitable line of business, because it cannot be much trouble to an electrical engineer to impart a little local colour to the type of installation upon which he has set his affections; and the estimates are seldom or never tested by execution of the work. In the present instance Mr. Preece has persuaded the Electric

Lighting Committee of the Vestry that it will be a prudent thing to spend £81,000 of the ratepayers' money upon an installation; but the main body of the vestrymen are by no means disposed to accept his estimates off-hand, and have postponed the final vote upon the proposition until the 7th prox. This caution is not surprising when it is seen that even the estimate only shows a margin of 4·6 per cent. upon the capital outlay, for profit; and nobody who knows how perniciously the unforeseen operates to disappoint those who trust the estimated returns from a speculative undertaking is likely to fancy Mr. Preece's figure. In order to induce this Local Authority to go into the business themselves, instead of patronizing a Company, Mr. Preece has assured them that they will be able to sell current at 6d. per unit. The reflection which seems to trouble the worthy vestrymen of Hampstead most in regard to this scheme is that if they adopt it they will be spending the money of all the ratepayers upon a speculation which will only cater for the rich minority. As though to emphasize this feeling, one vestryman has given notice of his intention to move, when the matter next comes on for discussion, "that in the event of there being a deficit on the year's working, the repayment of it shall be confined to persons rated at over £80 a year." This should help the Vestry to realize what they are doing in the matter.

A curious observation occurs in the report of the Hampstead Vestry Electric Lighting Committee which, as it has more than a local bearing, deserves attention apart from the particular application. It runs thus: "Other things being equal, it is evident that there would be this solid advantage in the means of electric lighting being in the hands of the borough, that the Vestry could at all times adopt and profit by the increase of scientific information, and the ratepayers would always have the means of procuring the redress of a grievance, and of insisting on efficiency of management." A finer example than this of bad reasoning from wrong premisses has seldom come under our notice. In the first place, profiting by the "increase of scientific information" means throwing away old plant and adopting new, which is the last thing a rate-supported body can bring themselves to do. Next, the example of gas-supplying local authorities completely contradicts the assumption that in such circumstances consumers' grievances are better redressed, or more efficient management secured, than when the local authority look after the proceedings of a trading company. It is notorious that the very opposite is the case.

The recent discussion upon gas-meters at the meeting of the Eastern Counties Gas Managers' Association has attracted the notice of representatives of the electric lighting interest, who are just beginning to experience what it means to supply by meter. The debate is summarized by the *Electrician*, which goes on to compare the conditions of working of gas-meters with electricity-meters. It is pointed out that gas managers cannot tell how much of the unaccounted-for gas is due to leakage from mains, and how much to the inaccuracy of consumers' meters; whereas the leakage to earth from electrical mains can be read off at once on an ammeter, and the discrepancy between the readings of the station meter and of the consumers' meters shows the mean error of the latter. Our electrical contemporary proceeds to quote a statement made by Messrs. Ferranti and Co. about the error of ampere meters, which argues that a supplying company may lose a great deal of money for a very small slip on the part of the meter. This is so, of course, if the consumer actually obtains the current, and uses it without the full amount being registered against him by the meter; but where the loss is pure leakage, its value must be computed at the prime cost of the commodity to the producer, not at its selling price.

Some remarks lately addressed to an American newspaper by Mr. Angus Sinclair, a locomotive engineer of much experience in England and the United States, upon the objection to electric arc lamps for railway tunnels are worthy of reproduction, inasmuch as they apply to street lighting as well as to the lighting of railway lines. Mr. Sinclair says it has become like second nature to him to watch for things that influence the safety of fast locomotion; and the result of his observations is decidedly antagonistic to the arc light. At first he was inclined to think that electric lights might be used with advantage (say) in surface railroad tunnels; but experience in fogs convinced him that the danger would be increased thereby. Mr. Sinclair describes the electric arc light in forcible terms as "all absorbent of vision." The light itself, he admits, can be seen at a considerable distance "but nothing else beyond it can be seen, and objects beneath it are almost invisible." And this is the light that the Commissioners of Sewers of the City of London contemplate setting up at the Mansion House, on Ludgate Hill, in Gracechurch Street, and at many other points where the heaviest and swiftest street traffic in the world is daily and nightly carried on, at enormous peril to life and limb. Every omnibus driver, cabman, and drayman in London would support Mr. Sinclair's dictum, made with reference to the driver of a locomotive, that "until he is under the light, nothing in front can be seen." The glare of the electric lamp puts everything else out of sight. In the case of arc-lit railway tunnels, "when free from smoke, steam, and fog, the arms of the signals will be visible; but at other times the engineers will have to feel their way from light to light, the danger of accidents will be increased, and the movement of trains will be exanimated." The last word, we take it, is superfine Americanese for delayed, or hindered. Mr. Sinclair's meaning, however, is clear enough.

## THE GREAT TANK AT EAST GREENWICH.

In last week's JOURNAL mention was made of the letting of the contract for the new six-lift South Metropolitan gasholder which is to be erected at East Greenwich; and it was stated that the cost of the new gas storeage capacity to be provided by this work will not amount to £5 per 1000 cubic feet capacity for tank and holder complete. Seeing that the holder itself will cost (in round figures) about £3 10s. per 1000 cubic feet capacity, the outlay for the tank cannot be more than 30s. per 1000 cubic feet, and will probably work out to something considerably less than even this moderate figure. We propose now, in consequence of the interest which the foregoing particulars must arouse, to give an account of "how it was done," from information supplied by Mr. Frank Livesey, the Chief Engineer of the Company.

It is hardly too much to say that the designing and construction of this phenomenal tank has been to all the prominent South Metropolitan officers concerned a veritable "labour of love," to once more employ a well-worn phrase. It is notorious that if there is any description of gas engineering construction in which Mr. George Livesey, the Chairman of the Company, takes special delight, it is gasholder work, and in a particular sense concrete tanks. The development of the huge East Greenwich station is one of Mr. George Livesey's peculiar cares, in the prosecution of which he sinks the Chairman in the Engineer to a greater degree than in regard to any other department of the Company's operations; and it must therefore be understood that, in the planning and execution of this remarkable piece of construction, the Chairman and the Chief Engineer worked hand in hand. It is unnecessary to repeat the discussions which preceded the resolution to put down, in the corner of the East Greenwich site reserved for storeage, the largest tank that could be conveniently got in. Suffice it to record that almost exactly a year ago a 5-feet annular trench was marked out on the ground, with an inner radius of 151 ft. 9 in., and the surface was broken in this shape for the largest gasholder-tank ever attempted.

We have on previous occasions mentioned the scheme of execution of the work; but it may be as well to repeat that, for several reasons, the Directors decided that the tank should be made by their own engineering staff and labourers, without the intervention of a contractor. This conclusion was facilitated by the fact of concrete being the selected building material; there being no skilled labour needed for concrete work. It was particularly desired also to find employment through the summer for the new stokers and general labourers imported during the previous winter, in order to do which it was essential that the work should be carried on at the Company's own convenience. Without any fuss to herald in the really important experiment—an experiment involving the expenditure of about £15,000—the job was therefore started by putting on the stokers as navvies, as they were slacked off from the retort-houses at the different stations. Meanwhile, all the "hard core" that could be accumulated from the clearing out of the retort-benches, the clinkers, burrs, &c., was barged down to the East Greenwich wharf, and tipped handy for concrete making. In addition to this, a quantity of clean Thames ballast, dredged from the river, was obtained for the same purpose.

The nature of the site must be borne in mind in order to a perfect understanding of the nature of the work. The holder that had already been erected alongside the proposed new monster, was in a tank 50 feet deep or thereabouts, the coping of which stood 13 feet above the average ground-level. In the execution of this work, an enormous quantity of water had to be pumped out of the land, which not only cost a heavy sum nowise represented in the ultimate structure, but caused widespread mischief all round the scene of operations. It was obviously most desirable not to have a repetition of this outlay and inconvenience; but the only alternative was to keep out of the water-bearing stratum underground. Anybody making a casual inspection of the East Greenwich site, outside the gasworks where the ground-level had in places been altered, would think at a first glance that this alternative was hardly a practicable one. Ditches standing full of bog-water line the roads of this dreary region; and at high tide the river which runs round the peninsula looks ready to overwhelm it. Like many other things, however, the ground is not quite so bad as it looks. The surface, which was originally garden ground, is firm soil, resting on about 3 feet of stiffish clay, such as is found all over the London basin. Underneath this is at least as thick a bed of firm peat, full of prostrate trees and roots, and yielding, curiously enough, vast numbers of hazel-nut shells, but no fossil remains of any kind. Beneath this comes bright, clean sand; and lastly gravel, upon digging into which to a depth of a foot the water is met with in practically unlimited quantity, since it rises and falls with the tide in the neighbouring river.

Upon surveying the site, therefore, the Engineers decided that they might safely contemplate sinking their concrete to an average depth of 14 feet from the surface, where, at the cost of a moderate amount of pumping, they would be fairly upon the strong foundation of the gravel, which would carry anything they wished to put on it. The depth of the tank would be necessarily diminished, as it was obviously undesirable to carry it too high above ground; so it was settled, not without regret,

that the tank should be no more than 31 ft. 6 in. deep above the rest-stones, or 32 ft. 6 in. deep to the floor, which would be made of 18 inches of concrete. The wall would therefore be 34 feet deep from coping to footing. The decision to excavate the whole interior area, and make the floor flat, was dictated by the necessity for obtaining sufficient material for backing the wall, and for removing all the peat and sand, which would have certainly proved troublesome under the unwonted load of some 30 feet of water.

The excavation went on without the slightest hitch or difficulty; the whole of the ring being taken out to the determined depth without more water being encountered than a 5-inch Pulsometer in a sump-hole alongside could satisfactorily deal with. The circle of the cutting was kept by planking from a simple trammell made of a strip of 3-inch by 1-inch timber, with a strip of flat iron screwed upon its upper face to keep it together and true. This long rod was pivoted upon a bolt sunk into a block in the centre of the tank, and carried upon packings at suitable intervals. Nothing more elaborate than this was found necessary. In a concrete tank, the prime essential is perfect rigidity. There must be no yielding, or the wall will crack. Consequently, in this case the trench was made the intended thickness of the wall, without allowing for any backing. Where the 5 feet of earth had come out, there the concrete went in; the timbering being drawn as the wall rose. Above ground, of course, the wall was made between frames. The thickness was diminished from 5 feet at the ground line to 3 ft. 6 in. at the coping. It is of uniform section all round, without piers. So carefully was the plumbing done by the foreman (Mr. Stradling), that no dimension of the interior of the tank, vertical or horizontal, differs from another by more than ⅛ inch. The work of excavating, setting the 48-inch inlet and outlet pipes (which are all of cast iron, built in solid concrete bedding), and forming the wall to the coping-level, occupied the whole of last summer to the middle of November. Indeed, the very last portions of concrete were covered up to set, as a protection from the frost, which almost caught the work. It was quite safe, however; and the Engineers took their concreters into the retort-houses with easy minds, and left their tank building to itself for the winter. Work was started again three weeks ago, when everything was found in perfect condition—the concrete as hard as iron, and the wall faces, back and front, showing without crack or flaw.

The method of making and using the concrete must now be described, as this is, of course, a most important matter. The "hard core" has already been mentioned as comprising two kinds of material—the clean river rough sand and gravel known as "Thames ballast," and retort-bench rubbish, &c. The ballast, clinker, and small grit was mixed on a platform, dry, with Portland cement, in the proportion of 9 to 1, turned over with shovels twice, wetted, and taken to the trench in barrows. All the larger stuff, however—pieces of retorts, fused lumps from the furnaces, &c.—was merely wetted thoroughly, and dropped by hand into the middle of the small concrete; care being taken to keep all such lumps at least 3 inches apart, and not to put them within 3 inches of the front or back of the wall. Then they were covered up with small concrete; and the same process was repeated all through the wall. The argument for this procedure is that the lumps are so hard and strong, that breaking them up and cementing them together again could not improve their structural efficiency in such a thick mass of walling; so that they are better for use as they are, if care is taken to properly bed them in the soft mass of cementitious material. Their presence reduces the proportions of the hard core and cement to at most 10 to 1. The cement used is the best slow-setting description, weighing 112 lbs. per bushel; the finely-ground quality being preferred. As received from the makers, it was emptied from the bags into a dry shed, where it was turned over on the floor, and left to cool for about a month before being used. This got rid of the danger from lime. The layers of concrete averaged a foot thick; and the wall was carried up uniformly all round; the old work being, of course, well wetted before the next deposit was laid upon it. The inner face will be rendered with two coats, making an inch thick—the second one being neat cement.

The strength of the wall does not, however, depend upon the unassisted tensile resistance of the cement in the concrete. At regular intervals from bottom to top, and nearer the back than the front of the wall, are inserted fifteen bond rings of flat iron on edge, 5 inches by ⅝ inch, riveted at the joints with six ¾-inch rivets. These are necessary in view of the fact that the backing of so much of the wall will be made-ground. A finishing-ring of the same is to be slipped over the outer edge of the coping, and driven down a few inches from the top, so as to lend additional strength to this part. The holding-down pieces for the guide standards are peculiar. They consist of three flat irons, 10 feet long by 10 inches wide, set at an angle in the cement. The lower ends are turned up into hooks to improve the grip, and one has hold of a bond ring, while a piece of old bar iron is dropped into the hooks of the others. The bottoms of the guide standards will be riveted to the tops of these anchorage strips, which have thus taken the place ordinarily filled by holding-down bolts. The tank guides will be of channel steel, secured to the wall by lewis bolts.

The earth backing round the tank is to be carried out 20 feet on the flat from the wall at the top, and thence sloped down to the ground level, which will give the wall all the support it can receive from this source. The work now in hand is the excavation of the ground from inside the tank, which is being done by hand. There is a striking paucity of the usual "contractors' plant" about this job; which appears strange until it is recollected that, huge as the tanks looks from inside or from the coping, most of it is out of the ground, and all the stuff that comes out of it has merely to be tipped against the wall. The soil is removed in barrows to two points, where horses draw up the full barrows, by means of gins, to the top of the wall, whence they are wheeled to wherever the filling is going on. The smaller the loads tipped, and the closer they are rammed down damp, the better for the work. A flying timber bridge ramp gives access to the inside for men and horses. The peat is good for charcoal making; and much of it is kept clean, and sold for this purpose, chiefly for use in sewage purification.

We cannot close this notice of a most interesting and instructive piece of work without praising all concerned for the admirable way in which, in its execution, difficulties have been converted into advantages, and uncompromising excellence secured at a phenomenally small cost. So well has everything been organized, that an untechnical onlooker would think the construction of a tank for a 300 feet gasholder the easiest and most every-day task imaginable. Indeed, the tank seems to be building itself, so far as the complete absence of all the usual "pomp and circumstance" attending a "big job" is evidence of the fact. The whole of the detailed responsibility for the work from the beginning has rested upon the foreman, Mr. Stradling, under the Engineer of the station, Mr. J. Tysoe.

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**Projected International Electrical Convention in Canada.**—Preparations are being made in Montreal for a great electrical convention in August, including an exhibition of apparatus made by Canadian and American electrical engineers.

**Mr. Henn Collins, Q.C.,** whose name will doubtless be remembered by many of our readers in connection with the proceedings of the Court of Appeal in the Lever case, in which he led for the Salford Corporation, has been selected to fill the vacancy on the Bench caused by the recent retirement of Mr. Justice Stephen.

**Large Coal Contract for the Chartered Company.**—By an advertisement which appears in another part of the JOURNAL, our readers will see that The Gaslight and Coke Company are inviting tenders for 1,750,000 tons of coal and 50,000 tons of cannel—together 1,800,000 tons—the quantity of raw material they expect to require for gas-making purposes for the year commencing on the 1st of July next.

**The Funeral of Mr. Stephenson Clarke** took place at Tooting Churchyard last Thursday afternoon, in the presence of a large number of relatives and friends of the deceased, and of several of the leading residents of Croydon. The coffin was literally buried in wreaths and other floral trophies. During the day evidence of the respect in which the deceased was held in Croydon was shown by the almost universal lowering of flags to the half-mast, and by the appearance of shutters and blinds at most of the principal shops and private houses.

**The Danger of the Proximity of Gas-Pipes to Electrical Conductors.**—The *Electrical Review* calls attention to the fact that at the time of the establishment of the first electrical canalizations in Paris, the dangers attendant upon the proximity of gas-pipes and electrical conductors were pointed out; and the explosion that took place a few weeks ago at a restaurant in the Place de la Madeleine fully justifies the apprehensions then expressed. The restaurant is lighted by electricity, receiving the current from an underground conductor connected with the main system of the street, which conductor crosses a gas-pipe supplying a kiosk. The lead of the pipe having become worn away, the gas escaped freely, and penetrated into the cellar of the restaurant, where an explosive mixture was formed, with the result stated. By laying gas-pipes and electrical conductors side by side, facility is afforded for accidents of this nature; and the present instance should serve as a warning for the future.

**Waverley Association of Gas Managers.**—The 60th half-yearly meeting of this Association was held at Haddington on Thursday last. There was a good attendance. The members first inspected the gas-works, in company with the Manager (Mr. W. Blair), and congratulated him on their condition. Then, under the guidance of Mr. James Robb, late Manager of the Haddington Gas-Works (who is the author of a popular "Guide to Haddington"), they visited the grand old Abbey, the historical points and architectural beauty of which were fully described by him. They then returned to the George Hotel, where they held their meeting—Mr. W. Thomson, of Duns, presiding. The Secretary (Mr. G. Taylor, of Jedburgh) read the minutes of the last meeting; and they were approved. The Association then appointed Mr. J. Smith, of Rosewell, President for the ensuing year; Mr. G. Taylor being re-elected Secretary and Treasurer. The business of the meeting was of a conversational character on various subjects of special interest to the members, including the high price of first-class cannel coal—all present taking part in the discussion. The business over, Mr. W. Robson, of Selkirk, presented Mr. A. Thomson, as the retiring President, with the Association's gold medal. The members and friends afterwards dined together. The next meeting is to be held at Jedburgh.

## ACCOUNTS OF THE METROPOLITAN GAS COMPANIES FOR THE YEAR 1890.

| — | Chartered. | Commercial. | South Metropolitan. | All the Companies. |
|---|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Capital and borrowed money | 11,362,500 0 0 | 810,000 0 0 | 2,949,351 0 0 | 15,121,851 0 0 |
| Income—viz.: | | | | |
| Sale of gas by meter | 2,313,442 11 2 | 213,629 18 10 | 619,246 12 2 | 3,146,319 2 2 |
| Public lighting, including lighting under contracts | 140,737 14 8 | 18,202 5 11 | 57,114 15 10 | 216,054 16 5 |
| Rental of meters and stoves | 65,924 6 2 | 4,852 0 0 | 20,342 0 2 | 91,118 6 4 |
| Residual products | 901,173 2 0 | 105,034 8 10 | 300,638 15 10 | 1,306,846 6 8 |
| Miscellaneous, including old materials | 12,072 12 9 | 470 5 3 | 7,759 19 2 | 20,302 17 2 |
| Total income from all sources | 3,433,350 6 9 | 342,188 18 10 | 1,005,102 3 2 | 4,780,641 8 9 |
| Expenditure—viz.: | | | | |
| Coals, including carriage and dues | 1,490,418 14 1 | 140,545 9 7 | 434,229 19 8 | 2,065,194 3 4 |
| Purifying materials, including labour | 74,121 16 1 | 7,380 19 6 | 18,163 16 5 | 99,666 12 0 |
| Salaries and wages—manufacture | 370,606 14 1 | 39,816 12 5 | 124,455 5 7 | 534,878 12 1 |
| Wear and tear—manufacture | 314,298 13 0 | 26,373 14 1 | 95,458 5 1 | 436,130 12 2 |
| Rents, rates, and taxes | 162,472 6 8 | 10,522 16 7 | 42,350 7 5 | 215,345 10 8 |
| Salaries—management | 15,728 13 10 | 2,179 8 0 | 4,204 16 6 | 22,112 18 4 |
| Collectors' salaries and commission | 29,147 3 7 | 3,074 18 7 | 10,381 4 8 | 42,603 6 10 |
| Stationery, printing, and general charges | 11,645 18 4 | 1,729 15 7 | 9,031 1 4 | 22,406 15 3 |
| Directors and auditors | 5,900 0 0 | 2,650 0 0 | 3,725 0 0 | 12,275 0 0 |
| Salaries and wages, wear and tear—distribution | 132,297 5 0 | 15,859 15 2 | 48,568 11 4 | 196,725 11 6 |
| Repair and renewal of meters and stoves | 76,722 12 7 | 4,739 6 10 | 14,463 19 9 | 95,925 19 2 |
| Law and parliamentary charges | 9,870 4 11 | 373 1 5 | 2,648 16 4 | 12,892 2 8 |
| Bad debts and extraordinary expenses | 37,874 4 4* | 3,628 7 3 | 39,642 13 8† | 81,145 5 3 |
| Total expenditure on revenue account | 2,731,104 6 6 | 258,874 5 0 | 847,323 17 9 | 3,837,302 9 3 |
| Gross profit | 702,246 0 3 | 83,314 13 10 | 157,778 5 5 | 943,338 19 6 |
| Do. per cent. on capital and borrowed money | 6 3 7 | 10 5 9 | 5 7 0 | 6 4 9 |
| Do. do. gas-rental | 28 12 3 | 35 18 9 | 23 6 6 | 28 1 2 |

* Including £18,961 16s. 11d. annuities.

† Including £31,978 19s. 2d. strike expenses.

## TABLE *showing the Capital, Income, Expenditure, and Profit, per Ton of Coal carbonized, in* 1890.

| — | Chartered. | Commercial. | South Metropolitan. | All the Companies. |
|---|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Capital and borrowed money | 5 16 3·30 | 3 17 3·73 | 4 12 6·20 | 5 7 11·44 |
| Income—viz.: | | | | |
| Total gas-rental | 1 5 1·37 | 1 2 1·52 | 1 1 2·60 | 1 4 0·04 |
| Rental of meters and stoves | 8·10 | 5·56 | 7·66 | 7·81 |
| Residual products | 9 2·66 | 10 0·30 | 9 5·16 | 9 3·95 |
| Miscellaneous, including old materials | 1·48 | 0·54 | 2·92 | 1·74 |
| Total income from all sources | 1 15 1·61 | 1 12 7·92 | 1 11 6·34 | 1 14 1·54 |
| Expenditure—viz.: | | | | |
| Coals, including carriage and dues | 15 3·02 | 13 4·97 | 13 7·45 | 14 8·91 |
| Purifying materials, including labour | 9·09 | 8·45 | 6·84 | 8·54 |
| Salaries and wages—manufacture | 3 9·51 | 3 9·60 | 3 10·85 | 3 9·82 |
| Wear and tear—manufacture | 3 2·60 | 2 6·21 | 2 11·98 | 3 1·36 |
| Rents, rates, and taxes | 1 7·95 | 1 0·05 | 1 3·94 | 1 6·45 |
| Salaries—management | 1·93 | 2·50 | 1·58 | 1·90 |
| Collectors' salaries and commission | 3·58 | 3·52 | 3·91 | 3·65 |
| Stationery, printing, and general charges | 1·43 | 1·98 | 3·40 | 1·92 |
| Directors and auditors | 0·72 | 3·04 | 1·40 | 1·05 |
| Salaries and wages, wear and tear—distribution | 1 4·25 | 1 6·16 | 1 6·28 | 1 4·85 |
| Repair and renewal of meters and stoves | 9·42 | 5·43 | 5·45 | 8·22 |
| Law and parliamentary charges | 1·22 | 0·43 | 1·00 | 1·11 |
| Bad debts and extraordinary expenses | 4·65 | 4·16 | 1 2·92 | 6·95 |
| Total expenditure on revenue account | 1 7 11·37 | 1 4 8·50 | 1 6 6·95 | 1 7 4·73 |
| Gross profit | 7 2·24 | 7 11·42 | 4 11·39 | 6 8·81 |

## TABLE *showing Increase or Decrease in each Item during* 1890 *compared with* 1889.

| — | Chartered. | | Commercial. | | South Metropolitan. | | All the Companies. | |
|---|---|---|---|---|---|---|---|---|
| | Inc. | Dec. | Inc. | Dec. | Inc. | Dec. | Inc. | Dec. |
| | £ | £ | £ | £ | £ | £ | £ | £ |
| Capital and borrowed money | 671,600 | .. | .. | .. | 99,355 | .. | 770,955 | .. |
| Income—viz.: | | | | | | | | |
| Sale of gas by meter | 162,397 | .. | 1,153 | .. | 32,545 | .. | 196,095 | .. |
| Public lighting, including lighting under contracts | 4,090 | .. | 247 | .. | 1,288 | .. | 5,625 | .. |
| Rental of meters and stoves | 7,583 | .. | 270 | .. | 2,595 | .. | 10,448 | .. |
| Residual products | 85,769 | .. | 18,846 | .. | 52,974 | .. | 157,589 | .. |
| Miscellaneous, including old materials | .. | 506 | .. | 154 | 3,221 | .. | 2,561 | .. |
| Total income from all sources | 259,333 | .. | 20,362 | .. | 92,623 | .. | 372,318 | .. |
| Expenditure—viz.: | | | | | | | | |
| Coals, including carriage and dues | 359,278 | .. | 20,582 | .. | 92,134 | .. | 471,994 | .. |
| Purifying materials, including labour | 15,721 | .. | 990 | .. | 2,211 | .. | 18,992 | .. |
| Salaries and wages—manufacture | 64,211 | .. | 6,490 | .. | 15,289 | .. | 85,994 | .. |
| Wear and tear—manufacture | 54,002 | .. | 2,982 | .. | 19,088 | .. | 76,072 | .. |
| Rents, rates, and taxes | .. | 910 | 498 | .. | .. | 115 | .. | 527 |
| Salaries—management | 804 | .. | 58 | .. | 133 | .. | 995 | .. |
| Collectors' salaries and commission | 76 | .. | .. | 99 | .. | 224 | .. | 247 |
| Stationery, printing, and general charges | 800 | .. | 161 | .. | 1,554 | .. | 2,515 | .. |
| Directors and auditors | .. | .. | .. | .. | .. | .. | .. | .. |
| Salaries and wages, wear and tear—distribution | 5,378 | .. | 8,047 | .. | 5,121 | .. | 13,546 | .. |
| Repair and renewal of meters and stoves | 23,774 | .. | 839 | .. | 1,680 | .. | 25,293 | .. |
| Law and parliamentary charges | 4,092 | .. | 189 | .. | .. | 86 | 4,195 | .. |
| Bad debts and extraordinary expenses | 984 | .. | .. | 353 | 2,015 | .. | 2,646 | .. |
| Total expenditure on revenue account | 528,210 | .. | 35,388 | .. | 138,800 | .. | 702,398 | .. |
| Gross profit | .. | 268,877 | .. | 15,026 | .. | 46,177 | .. | 330,080 |
| Do. per cent. on capital and borrowed money | .. | £2 18s. 1d. | .. | £1 17s. 1d | .. | £1 16s. 2d. | .. | £2 12s. 9d. |
| Do. do. gas-rental | .. | 13 16 9 | .. | 6 14 9 | .. | 8 8 4 | .. | 12 4 8 |

## NOTES.

### Andrews Fuel Gas.

The Acmé liquid fuel gas process, stated to be the invention of a Mr. Andrews, "gas expert and inventor," of New York, was recently described in the *American Manufacturer*. The account of this process begins by stating that, although the number of oil-gas processes is almost unlimited, those that have been successful in producing a good gas at a reasonable cost "may be counted on the fingers." The defects of most processes of the kind are obligingly pointed out. With the bulk of them it has been the custom to inject directly into a retort, either large or small, oil mingled with superheated steam, and in some cases with air. Where large retorts have been used, a considerable portion of the liquid hydrocarbons not in actual contact with the heated surfaces of the retorts passes through them without being thoroughly vapourized; while where small retorts or pipes have been employed, and the oil has been injected into them in its liquid form, they have become clogged with graphite. Recognizing these and other defects in many existing and previously tried processes, Mr. Andrews designed his own to overcome them. By the Andrews process, the oil (which may be Lima or common crude oil) is heated in superheaters, "which subject it to great heat, and gasify it previous to its introduction to the pipe retorts; thus obviating the deposition of graphite in them, and preventing the possibility of their clogging." In what respect a "superheater" differs from a "retort" is not stated. The special Andrews retort consists of an annular pipe—the outer of cast iron, and the inner of copper. Oil vapour travels through one, and superheated steam through the other; and at the end "the inner pipe ceases, the two gases mingle, and destructive distillation takes place in a vacuum—a fixed hydrocarbon gas being the result." The illuminating gas made is of 28-candle power; and it is, of course, recommended for fuel purposes. But what are the "new and valuable features" of the plant, which are reported to command success in the gas-works at Saratoga, remains a mystery.

### A Problem in Heat.

A curious problem in the Science of Heat is given by the *Engineer* in connection with Mr. John Kirkaldy's arrangement of heating feed water by live steam withdrawn for the purpose from the boiler. It appears that, purely with a view to saving the racking of the plates of boilers by the introduction of feed water at a temperature much below that of the steam and water inside, Mr. John Kirkaldy devised a novel kind of feed-water heater; using fresh steam from the boiler for it, in order to make the feed as hot as the contents of the boiler. In doing this, he had no idea of economy, and was probably prepared for a slight loss in consequence of the impossibility of imparting to the inflowing water all the heat of the effluent steam. Greatly to his astonishment, however, Mr. Kirkaldy discovered that steam plants fitted with the new heaters did the same work with 10 per cent. less fuel consumption than they had previously required. In another case, a boiler that had been designed to carry 140 lbs. of steam, but which could never, with the most careful stoking, keep more than 90 lbs., went up to the full pressure of 140 lbs. with ease when fitted with the Kirkaldy heater. This result is quite inexplicable by all the laws of heating that have ever been brought into use in connection with steam raising. There seems to be no question as to the facts; but how the result is attained nobody is able to say. Certainly, if anything of the kind had been predicted, the prophet would have been declared mad in every physical class-room in the Kingdom. Now it remains for the professor, as usual, to follow the engineer, and tell him why his plans have succeeded.

### The Archer Fuel-Gas System.

Our American contemporary *Progressive Age* recently published an illustrated description of the Archer fuel-gas process, which is stated to be actually in operation in many large manufacturing establishments, and is credited with "performing in a most satisfactory manner, both in economy and improvement in quality of product, a greater diversity of work than any other system before the public." This is a water-oil-gas process. Petroleum forms the basis; the gas is the result of a double decomposition of oil and steam. The apparatus is described as perfectly automatic; but our contemporary appears disinclined to give particulars of how the arrangement works. Five sizes of producers are made; the largest, for manufactories, occupying a ground space 6 ft. 6 in. square. The smallest is 39 inches in diameter by 4 ft. 6 in. high. The special features of the Archer process are stated to be the production of a clear, pure, and smokeless fuel gas, made from mineral oil and the hydrogen liberated from steam, which can be used in place of coal and other fuels for all manufacturing purposes. The heat produced is "uniform"—whatever this means—and equal in all respects to natural gas, and "superior to coal or coal gas; being free from sulphur and all other objectionable substances." How "heat" can be contaminated with "objectionable substances" is not so clear as might be wished. "As an evidence of the caloric power of the Archer process gas," we are informed, "it may be stated that only 2-inch pipes or mains are required to supply furnaces which with natural gas require 6-inch pipes or mains, or 25 to 30 inch mains for coal gas." It is to be feared that this way of measuring the heating power of a fuel gas will strike certain critics as somewhat lacking in precision. The nearest approach to an exact statement upon this head is that of the Superintendent of the Pennsylvania Steel Company, who reports that in his works "55 gallons of oil by the Archer process equal a ton of bituminous fuel"—which speaks very well for the gas, or very badly for the coal. Meter measurement of fuel gas seems to be regarded as superfluous labour in the United States. It can at least be said that the Archer generator looks a compact, workmanlike apparatus.

## COMMUNICATED ARTICLE.

### THE STANDARD OF LIGHT.

By Walter Grafton, of The Gaslight and Coke Company, Beckton.

Exhaustive experiments have been made on this standard, by the Board of Trade Committee, The Gas Institute Committee, and by a few other experimentalists; and they unanimously raise some objection to its use. In no case, however, have they given explicit reasons for the standard candles varying as they do. The Board of Trade Committee remarked—"that candles are not of constant composition; that the melting point of the sperm varied; that the number and size of the threads in the wick, its treatment and closeness of the plaiting of the strands, &c., affect the light of the candle; and that manufacturers differ in regard to them." All this is very true; but one or two very important things have been omitted. Manufacturers do differ somewhat in their methods of preparing the standard candle; and if this can be raised as an objection, it would be desirable that the manufacture of the candle be put into the hands of one firm. The error hitherto made in the making of the wicks is that the degree of tightness is reduced with the number of threads. Consequently the wick, when enveloped by sperm and lighted, has not sufficient rigidity to maintain a curvature which is slightly bent from the upright, but assumes a curvature which the writer calls "quarter-bend." It has been found that it is only when the wicks are made up of 54 (and under this number) threads that any decided difference is observable. For where the wicks are plaited in a corresponding degree tighter for every reduction in the number of threads, the error is greatly obviated. The number of threads in the wick should not be less than 60; and these should be made into three strands, plaited to a degree of tightness equal to 19 or 20, as represented by the machine. It is the closeness of the plaiting, rather than the number of threads, that has to do with the light developed by candles. The composition and melting point of the sperm do not sufficiently account for the great variation in the results obtained with this standard. If any variation be attributed to these points, it can be easily overcome by regulating the size of the wick. It is advanced by some, that so long as the Metropolitan Gas Referees' "Instructions" continue in their present form, gas-testing cannot be performed in a thoroughly scientific manner; and certainly photometric specialists agree in believing the candle to be a most unreliable standard, or at all events, in its present mode of manipulation, unsatisfactory.

The object of the writer of this article is to set forth a few important facts in connection with the standard candle in its relation to gas-testing. It may, therefore, be not unfitting to commence by dealing with the preparation of the candle. The best mode is to divide a candle (as near the centre as possible) into two halves; and then separate ¼ inch of sperm from the top of the lower half and the bottom of the upper half of the candle. These small pieces are easily pulled off after the separation has been effected. The method of gradually cutting away the sperm is bad, since great care must be exercised or the wick will be cut in places, and much damage thus done. Besides, by paring away the sperm, the plaiting of the wick becomes loose; and in this state, it is some time before the candle arrives at its normal condition. Pulling off the sperm does not disturb the strands of the wick, but leaves the wick compact and firm.

All candles have to be preliminarily prepared ere they are in a fit state for testing. A new candle after lighting requires, as a rule, to be held in a horizontal position and (with its wick as an axis) turned round a few times to melt off some of the sperm, and to get rid of the ragged end of the wick. This is especially so, if the wick were cut instead of being broken in two. But in either case, if the wicks be a good ¼ inch long, and they be merely lighted and left to burn, it will be found that the ends are not ragged but compact.

When it is desired to employ candles which have been previously used, the wicks should be thoroughly well lighted by means of a batswing or fishtail gas-flame; but they should not be touched. It should be especially observed that in the case of the standard candle, the sperm at the base of the exposed part of the wick should be melted simultaneously with the lighting of the wick, in order that combustion may proceed without check. This must be done with care, and in such a way as will not allow the melted sperm to overflow and run down the candle. The usual way of making a testing is to simply light the candles, and allow them to burn at least 10 minutes, so as to attain their normal rate of burning—not normal condition—before making a testing. After seeing that the wicks are at the prescribed angle to each other, and have red points, the testing

may be made in the usual manner. The candles are weighed; the readings of the discs taken; and the time noted which the candles occupied to consume 40 grains of sperm. The necessary calculations are now made; and the test is complete. If during the testing the candles behaved in accordance with the tester's instructions, the testing complies with the "Notification" issued by the Gas Referees. This test will represent the gas to be of a certain illuminating power. But the result is not correct, as will be proved further on. The curvature and formation of the wicks have a most gigantic influence upon the result of a testing. The Referees lay down no rules respecting the formation of the wicks. They only specify them to have a certain relative position to each other; and until something more definite than the present form of instructions for gas examiners is laid down, there will always be dissatisfaction on the part of both gas companies and the public (as represented by the controlling authority) while the candle reigns supreme as the standard of light.

Speaking generally, photometrists have very little knowledge regarding the causes of the variableness in the candle. They know they often burn outside the limits for the consumption of sperm; but they can give no actual reason for their doing so, even when testing the same gas with the same candles. No matter how large the difference between the results may be, the testing (they argue) must be right so long as the candles burned within the limits laid down in the regulations. Evidently there exists a grave mistake here. It is also evident that all the candle experiments made in the past were made at random. By this is meant that the wicks were anyhow; for in the published papers a difference of from 1 to 4 candles is very conspicuous between the tests made on a constant quality of gas. Now, had all the candles been treated alike, such differences could not have been found. The consumption of sperm, too, was not taken into account, as it ought to have been; for experiments have been recorded where the consumption was as low as 99 grains, and as high as 135·4 grains, while the predominating figure was below 114 grains, per hour.

Many photometrists, immediately before or after blowing out the candles, add sperm to the ends of the wicks by touching them with a piece of sperm. This they contend preserves them in good condition. Mr. Hartley, in his "Gas Analyst's Manual," mentions the practice. He says: "Always extinguish the candles in the way described, and thus preserve their wicks in good condition." The writer believes the plan to be quite useless, and nothing is gained in doing so; but on the contrary, if any, a prejudicial effect, so long as candles are lighted as at present. For take a pair of candles which have been treated in this manner, and simply light their wicks. They do not burn immediately as they did prior to being blown out. The flames run down the wicks, and the candles burn brightly enough for a little while, until all the sperm contained in the wicks is consumed, after which the flames, not being supplied with molten sperm, consume some of the wicks, and in doing so, the remaining unconsumed wicks turn over, forming "quarter-bends." The light meanwhile has reduced; but it gradually increases when the sperm becomes melted and supplied to the wicks. Moreover this bending is not got rid of after 10 minutes' burning. The writer has compared lighting candles whose wicks were saturated with sperm before being extinguished (as Mr. Hartley advises) with those which were extinguished in the ordinary manner—by simply blowing them out. The behaviour of both is identical just after being lighted. If, however, a candle be lighted in the manner described in an earlier part of this article, there is no great diminution of light, no bending of the wick; and there being no bending of the wick, there exists no liability to "gutter." The reason is obvious. The wick at the starting has a sufficient supply of molten sperm at its base to carry on combustion without check. Sometimes a candle will prove to be somewhat obstinate and commence to burn unsatisfactorily. A little judicious treatment ought then to be employed. Very little will often put a candle right, and many a test could be righted by gas examiners if more concise and definite rules were laid down for their guidance in the treatment of candles.

In burning, the wicks should remain closely woven, presenting clear, solid, glowing ends; and they should only be slightly bent. Mr. Hartley says: "The wicks should appear compactly woven, and not bent to an exceeding degree out of the upright." In the second part of Schedule A of the Gas-Works Clauses Act Amendment Act, 1871, it is laid down: "The wick is slightly bent, and the tip glowing." The words "slightly bent" appear rather vague; certainly they do not convey the same meaning to individuals. The proper curvature which the wick ought to possess may be seen after a candle has burned from 20 to 30 minutes. But so long as wicks are simply lighted and left to themselves for only 10 minutes, there will be no uniformity of bend; and, as the writer will clearly prove, there can be no regularity in the results of tests, even of the same gas.

The present standard of light is such that no reliable results can be obtained with it unless it is used according to definite rules—rules which will, under all conditions, have a definite and direct bearing upon the treatment of the candles, in such a way as to insure practically invariable results. Standards of light are manufactured, however, all of which have been compared with the candle, and are said to be reliable. It is true they may be reliable; but is the light emitted equal to one candle power or a multiple of it? This is a difficult question to answer. They may be good and invariable instruments; but since they were standardized by the present standard (and it being unreliable), they cannot be accurate, except in so far as they represent the average result of a series of tests, that may have been good, fair, or indifferent. To define precisely what a candle's light is, is difficult; but certainly the definition should embrace more than a mere statement that a standard candle must burn 120 grains of sperm per hour, and that six of such candles go to the pound. It is generally accepted that no two candles give exactly the same light; then what is a candle power? Photometrists are faced by this difficulty at the very commencement; and in a very great measure they are compelled to accept the term "one candle power" really for what it is worth.

*(To be continued.)*

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**Cancer and Coal-Tar Derivatives.**—It is stated that a Vienna doctor has declared that cancer can be arrested, if not cured, by an injection of the dye methyl violet.

**The Gas Supply of Paris.**—In connection with the statistics of the gas supply of the Metropolis in the past year which appear in another part of the JOURNAL to-day, it may be of interest if we give a few particulars in regard to the business of the Paris Gas Company during the same period, pending the publication of our abstract translation of the report presented by the Directors at the annual meeting of the Company on the 26th ult. In the twelve months ending Dec. 31 last, the capital expenditure on the works was increased by £262,381; bringing the total amount spent thereon up to £11,305,983. The revenue from all sources was £4,135,084; the expenditure, £2,654,486. Of the total receipts, £3,162,777 was for gas, and £630,075 for coke. The net profit realized was £1,468,000, out of which a dividend at the rate of 75 frs. per 250 fr. share (or 30 per cent.) has been declared. During the past year the quantity of gas sent from the works amounted to 10,867¾ million cubic feet, which was a falling off, as compared with 1889, of 155 million cubic feet. This difference is accounted for by the exceptional demand for gas during the period of the exhibition. The quantity of gas burnt last year, however, was rather more than 350 million cubic feet in excess of that consumed in 1888; so that the rise may be averaged at 176¾ millions per annum. The day gas sold was about 26 per cent. of the entire bulk delivered. In the matter of residuals, less coke was produced, but more was sold, in comparison with the previous year; and the treatment of the other products yielded better results by 10 per cent. than before. With regard to the negotiations still dragging on between the Company and the Municipality, on the subject of reducing the price of gas, the latest step appears to have been the submission of a fresh Treaty to the administration; the Company's former proposal that their present concession should be extended for 25 years having been rejected.

**The Gas Supply of Buenos Ayres.**—Some time ago Mr. George Ernest Stevenson, M. Inst. C.E., presented a paper to the Institution of Civil Engineers on "The Gas Supply of Buenos Ayres"—a subject with which he was specially qualified to deal from personal knowledge, having held the appointment of Engineer of the New, and subsequently of the Co-operative Gas Company in that city. The paper appears in Part I. of the minutes of proceedings of the Institution for the present session (Vol. CIII.). The author states that there were in Buenos Ayres no less than five Companies possessing the privilege of supplying gas to private consumers throughout the municipal limits—viz., the Primitive Company, the Argentine Company, the New Company, the Belgrano Company, and the Co-operative Company; and the central portions of the city became a battle-ground in which three of them contested the field for nearly twenty years—giving rise to unnecessary expenditure of capital and increased cost in the production of gas. Mr. Stevenson gives a short history of the first four of these undertakings, and indicates the improvements effected in their works. At the close of the year 1889 the average daily make of gas therein was 2,600,000 cubic feet, or equal to about 950,000,000 cubic feet per annum, of which about 15 per cent. was lost by leakage. He next deals with the regulations respecting the supply and quality of gas, the price charged, and the cost of manufacture. He puts the last at 8s. 10d. per 1000 cubic feet of gas consumed; and to this he adds 1s. for distribution, and 1s. 6d. for management—making a total of 11s. 4d. During the past three years, owing to the rise in the premium on gold, the original price of 20s. 8d. per 1000 cubic feet has, in effect, been reduced to 10s. 4d.; but the Companies have increased their charges by 25 per cent.—bringing the price up to 12s. 11d. There is consequently a profit (obtained from the private consumers only) of 1s. 7d. per 1000 cubic feet. Mr. Stevenson next gave particulars as to the Co-operative Company, formed in 1887, whose works he designed; their cost, with the mains laid, amounting to £210,000. This Company has now amalgamated with the Argentine Company. The paper was accompanied by three plans—the first showing the position of the gas-works and the area supplied by each Company; the second, the distribution arrangements carried out by the author for the New Company; and the third, the system of mains and the district occupied by the Co-operative Company. Drawings of the principal portions of the latter Company's works are in preparation, and will be issued with early numbers of the JOURNAL. Mr. Stevenson has lately returned to England, and has now an office at No. 9, Temple Chambers, Temple Avenue, E.C.

# TECHNICAL RECORD.

## SOCIETY OF CHEMICAL INDUSTRY.

**The Analysis of Illuminating Gases—The Analysis of the Products of Incomplete Combustion.**

At the Meeting of the London Section of the above Society yesterday week, at Burlington House, Piccadilly, Professor VIVIAN B. LEWES, F.I.C., F.C.S., of the Royal Naval College, Greenwich, read two papers—one dealing with the analysis of illuminating gases, and the other with the analysis of the products of incomplete combustion. The following is an abstract report of the papers and the discussions which followed them.

### THE ANALYSIS OF ILLUMINATING GASES.

Professor LEWES commenced this paper by observing that during the past year he had had to make analyses of coal gas and water gas carburetted with the hydrocarbons obtained by "cracking" various grades of petroleum oil. At the outset, he found so many difficulties that he thought his experiences, and the conclusions he had arrived at, might be useful to others engaged on similar work. Proceeding, he described the methods of analysis devised and perfected by Bunsen as being far too tedious to permit of their being employed for practical purposes; whilst many of the newer processes and forms of apparatus were, he said, so fraught with error that the results obtained were more likely to create confusion than to serve any useful end. After careful consideration, he adopted the form of apparatus introduced by Mr. J. E. Stead, the main principle of which he explained. In the first analyses made with this apparatus, the author was struck by the insufficiency of detail to be found in the various works on gas analysis; and he also discovered that wide discrepancies existed in the results obtained on making several analyses of the same gas. Taking illuminating gas or carburetted water gas, he pointed out that the chief constituents to be determined were hydrogen, hydrocarbons, carbon monoxide, carbon dioxide, nitrogen, and oxygen; while under certain conditions, it was important to know the percentages of acetylene, sulphuretted hydrogen, and carbon disulphide present. None of the analytical schemes set forth in the text-books gave anything approaching concordant results in his experiments; and although with an ordinary coal gas, he was able to get two analyses of the same sample within a few per cent. of each other, carburetted water gas gave such widely different results that it was evident something was radically wrong. The results of the experiments soon showed that, even with common coal gas, the ordinary method of analysis was absolutely useless, as the cuprous chloride employed to absorb carbon monoxide was nearly as good an absorbent for unsaturated hydrocarbons and oxygen as the liquids generally used for their determination; and this was the case whether it was used in acid or ammoniacal solution. A still more serious cause of error applied to all methods of analysis which Professor Lewes had seen suggested. All researches on the composition of coal gas pointed to the presence of ethane, and probably of higher members of the marsh gas series; while in carburetted gases they were undoubtedly present to a far greater extent. Ethane, propane, and butane had all been shown to be present in small quantities. Seeing that ethane gave double, propane three times, and butane four times its own volume of carbon dioxide, it was evident, he said, that exploding with oxygen, and taking the volume of carbon dioxide as representing marsh gas, would undoubtedly give too high results with ordinary coal gas; while with carburetted gas, it would render the whole of the analysis useless. Moreover the free oxygen was next absorbed, and the remainder taken as nitrogen; and the volume of gas was taken as representing the hydrogen in the gas. The result was that the hydrogen was far too low, not only because the volume of marsh gas was too high, but because the residual nitrogen, having to bear the brunt of all the errors of analysis throughout some seven or eight absorptions, was always too high. These errors in the quantity of marsh gas and hydrogen rendered worthless the calculations of the carbon and hydrogen density of the gas, on which great stress had been laid as showing the composition of the hydrocarbons present. On the whole, therefore, it was not to be wondered at, said the anthor, that no relation had been discovered between the carbon and hydrogen density and the illuminating value of the coal gas.

The author then described a series of experiments which he had made with a view of determining the best order in which to use the various absorbtive liquids, and also to find how far an absorbent could be found for the ethane, propane, and butane. Preliminary experiments showed him that these latter were taken up by alcohol, olive oil, or paraffin; the last-named, when properly prepared, being by far the best and quickest absorbent of the three. To make the experiments as definite as possible, solutions of known strength were employed; those which the author found to be the most advantageous being described by him. The gases, he continued to remark, were obtained as nearly pure as was compatible with ordinary manipulative precautions and methods of purification; and the percentage of gas and the nature and percentage of impurities were ascertained—the absorption figures given in the tables being in each case the amount of pure gas taken. Having explained the mode by which he prepared the methane, ethane, ethylene, carbon monoxide, and oxygen, the author said that water was used as the trapping fluid in all the experiments. In each determination, the gas was, after measurement in the eudiometer, run into the laboratory vessel, and allowed to stand quietly for ten and twenty minutes respectively over the absorbing fluid, the amount taken up being measured at the end of each period; whilst in a second experiment, the absorbent liquid was kept agitated for the same length of time in contact with the gas. The following table (which was exhibited in the room) contains the results of the experiments:—

| Absorbent. | Still. | | Agitated. | |
|---|---|---|---|---|
| | 10 min. | 20 min. | 10 min. | 20 min. |
| *Ethylene.* | | | | |
| Nordhaüsen acid | 6·2 | 7·80 | 97·0 | 100·0 |
| Fuming nitric acid | 9·4 | 9·87 | 93·5 | 93·5 |
| Bromine in potassic bromide | 99·2 | 100·00 | 100·0 | 100·0 |
| Alcohol | 17·0 | 56·70 | 75·0 | 57·0 |
| Paraffin | 53·1 | 62·50 | 87·5 | 75·5 |
| Acid cuprous chloride | 44·6 | 55·50 | 94·4 | 100·0 |
| Amm. cuprous chloride | — | — | — | — |
| Alkaline pyrogallate | — | — | — | — |
| Sodic hydrate | 37·5 | 50·00 | 93·7 | 93·7 |
| *Ethane.* | | | | |
| Alcohol | 46·4 | 60·7 | 89·2 | 89·2 |
| Paraffin | 82·1 | 89·2 | 100·0 | 100·0 |
| Olive oil | 10·7 | 17·8 | 92·9 | 96·4 |
| Bromine in potassic bromide | — | — | — | — |
| Fuming nitric acid | — | — | 6·4 | 53·6 |
| Nordhaüsen acid | — | — | — | — |
| Acid cuprous chloride | — | — | — | — |
| Amm. cuprous chloride | — | — | — | — |
| Alkaline pyrogallate | — | — | — | — |
| Sodic hydrate | — | — | — | — |
| *Methane.* | | | | |
| Alcohol | 11·2 | 16·9 | 43·9 | 57·8 |
| Paraffin | 19·6 | 36·9 | 64·2 | 66·7 |
| Olive oil | 2·5 | 2·5 | 11·5 | 25·5 |
| Bromine in potassic bromide | — | — | — | — |
| Fuming nitric acid | — | — | 5·78 | 11·5 |
| Nordhaüsen acid | — | — | — | — |
| Acid cuprous chloride | — | — | — | — |
| Amm. cuprous chloride | — | — | — | — |
| Alkaline pyrogallate | — | — | — | — |
| Sodic hydrate | — | — | — | — |
| *Carbon Monoxide.* | | | | |
| Acid cuprous chloride | 83·1 | 90·0 | 98·8 | 100·0 |
| Amm. cuprous chloride | 35·5 | 57·7 | 97·7 | 100·0 |
| Nordhaüsen acid | — | — | — | — |
| Bromine in potassic bromide | — | — | — | — |
| Fuming nitric acid | — | — | 4·8 | 4·8 |
| Alkaline pyrogallate | — | — | — | — |
| Sodic hydrate | — | — | — | — |
| Paraffin | — | — | — | — |
| Alcohol | — | — | — | — |
| *Oxygen.* | | | | |
| Alkaline pyrogallate | 84·2 | 88·4 | 92·6 | 100·0 |
| Acid cuprous chloride | 25·2 | 50·5 | 71·5 | 88·4 |
| Nordhaüsen acid | — | — | — | — |
| Bromine in potassic bromide | — | — | — | — |
| Fuming nitric acid | — | — | — | — |

The author pointed out that these experiments showed that none of the absorbents used could be employed to separate ethane or other members of the paraffin series from the methane, as the latter gas was soluble in all of them. Some further experiments, however, showed that, in mixtures of ethane and methane, contact with paraffin, with occasional agitation for from twenty to thirty minutes, removed all ethane and a large proportion of the methane, the remainder of which could be determined by explosion and estimation of the carbon dioxide formed—the volume absorbed by the paraffin, *plus* the volume of carbon dioxide produced on explosion, giving the total volume of saturated hydrocarbons. Reference was here made to experiments with the unsaturated hydrocarbons, which showed that it was not possible, by any of the absorbents at present in use, to effect a separation. The author then stated that his experiments clearly fixed the order in which the absorptions must be made, but only gave a general indication of the time necessary to complete the estimation of small quantities of any particular gas in the presence of a large volume of diluents. This he had attempted to determine by making and analyzing mixtures containing known volumes of the various gases; and the general scheme of analysis which gave him the best results was as follows: Two carefully calibrated Stead's apparatuses were taken—one containing mercury as the trapping fluid, the other water, over which all the ordinary absorption analyses might be made; the mercury apparatus being kept for explosion and subsequent estimation of carbon dioxide. (1) Carbon dioxide and sulphuretted hydrogen were first absorbed by 50 per cent. sodic hydrate solution; ten minutes' agitation being sufficient to complete the absorption. (2) The oxygen was next absorbed; 20 minutes being, as a rule, needed to complete the absorption. (3) The unsaturated hydrocarbons were then estimated by absorbing with a soluiton of bromine inpotassic bromide, and the action completed in fifteen minutes with gentle agitation. Bromine vapour was absorbed before measurement by agitation with sodic hydrate. (4) Carbon monoxide was next absorbed by acid cuprous chloride, which, the author remarked, must not be used more than twice with gases containing 20 per cent. or upwards of monoxide, nor more than four times with ordinary coal gas. As much as could be absorbed would be taken up in 20 to 30 minutes with agitation. (5) The saturated hydrocarbons were now partly absorbed by paraffin oil; 30 minutes being

required to ensure complete removal of the last traces of ethane, butane, &c. A portion of the remaining gas was run into the mercury eudiometer, measured, mixed with excess of oxygen, and exploded; the carbon dioxide formed being then absorbed over sodic hydrate—giving the volume of methane unabsorbed by the paraffin. He mentioned that in exploding, the taps of the apparatus should be secured by an india-rubber band, as the shock sometimes loosened the cock, and caused a leakage. (6) Having determined the gases soluble in sodic hydrate, the oxygen, unsaturated hydrocarbons, carbon monoxide, and saturated hydrocarbons, it would be quite allowable to absorb excess of oxygen by alkaline pyrogallate, and take the residual gas as nitrogen, calculating the hydrogen by difference. It must be remembered, however, that in each observation some small error had crept in, and the total of these having to be borne by the residual gas of ten operations brought out the nitrogen far too high. To eliminate this error as far as possible, the author said he started with a fresh measured volume of the gas, mixed it with a large excess of oxygen, and exploded over mercury, and then treated the residual gas with a strongly alkaline pyrogallate for twenty minutes; keeping it well agitated in contact with the gas. This absorbed both carbon dioxide and excess of oxygen; and an accurate determination of the nitrogen was obtained. The analysis so far was as follows: (1) Carbon dioxide and sulphuretted hydrogen; (2) oxygen; (3) unsaturated hydrocarbons; (4) carbon monoxide; (5) saturated hydrocarbons; (6) nitrogen; and (7) hydrogen, by difference. With ordinary manipulative skill in transferring the gases from the eudiometer to the absorption vessels and back again, the results would be fairly accurate; the carbon monoxide, however, being probably from 0·5 to 1 per cent. too low, and, in consequence, the saturated hydrocarbons the same amount too high.

In the next portion of the paper, Professor Lewes said that to complete the analysis with ordinary coal gas, and to trace the action going on in many forms of carburetting apparatus, it was necessary to be able to estimate the butylene, sulphuretted hydrogen, and other sulphur compounds which were likely to be present in minute traces, and which could not be determined by any volumetric method of the above character. He described in detail a process for doing this as proposed by Winkler; and then concluded by saying that up to now he had found no simple and reliable method for the separation and estimation of the various hydrocarbons present in illuminating gas, and, until this was done, gas analysis could not be of its full value in helping to clear up many points which were still difficulties in the complicated question of carburetting gases. He hoped, however, that the work he had brought before the Society would be a help to others who, like himself, had had to take up the subject of the analysis of illuminating gases; as although such a method as he had described left much to be desired, it gave fairly correctly the salient points of importance to the gas manufacturer and consumer. Two such analyses could, with good management, be made in a day, so that the amount of time expended was not prohibitive; and he could not help thinking that, if some of those gentlemen who claimed to be able to make an analysis of an illuminating gas in something under an hour, were to check their methods on known mixtures, they would be considerably startled at the results.

In the course of the discussion which followed the paper,

Mr. T. S. Lacey said he did not suppose there were many gentlemen present who had made analyses of illuminating gas; but he thought that anyone who had had anything to do with this difficult branch of analysis would feel very deeply indebted to the author for the work he had carried out. The text-books seemed to treat the subject as being very simple; and one would imagine from reading the descriptions of the processes that they could be carried out with the most marvellous accuracy. But when they came to actually do the work, and especially if they did this very rare thing—attempt to repeat their analysis under slightly different circumstances, they found that discrepancies occurred. Finding out the conditions which caused these discrepancies was the important point. One of the most difficult things was to know how much oxygen to mix with any gas in order to cause its perfect combustion without acting upon the nitrogen present in the mixture. With a residual gas, they were uncertain as to how much oxygen to use and what pressure to explode it at; and if Professor Lewes could give them some information on this point, it would be very valuable. With too large an excess or too small an amount of oxygen, different results were obtained. There was one possible mixture which would give tolerably accurate results; but it was very difficult to know whether or not one had complete combustion. Then with regard to the question of absorbing the gases of the methane series. When sulphuric acid was the absorbent used, none of the paraffins were absorbed; and they constituted an important part of the mixture, and might very much affect the illuminating power. The figures in the paper would be of great use to those who had to perform any of these analyses; and if Professor Lewes could give them further details, they would constitute a valuable addition to the limited amount of information that existed at present on this subject. He would like, in conclusion, to ask one question—that was, how the bromine was used, and could it be used over mercury.

Professor Lewes replied that the absorptions were all made over water. He only used mercury-trapped eudiometers for estimating the carbon dioxide in the gas.

Professor W. Foster dealt at some length with various points raised in the paper. He remarked that it was interesting to hear the author recounting the difficulties that one met with in making gas analyses—difficulties which he (the speaker) had encountered some six or seven years ago; but he believed that Professor Lewes would have to modify some of the assertions he had made. Sulphuric acid he had found was a perfectly good absorbent; and he did not think the author would improve upon it as an absorber of hydrocarbons. He had spent some considerable time in trying to get rid of Nordhaüsen acid; and had come to the conclusion that it was probably possible to replace it.

Professor Lewes, in reply, said he thought Mr. Lacey had brought forward one or two good points; one being the conditions under which they had the explosion taking place, and how those conditions were to be modified so that there should not be any oxidation of the nitrogen going on at the same time as the explosion. He believed Mr. Lacey would agree with him in this—that the absorption of the higher paraffins was a very distinct step in this direction. If they absorbed the higher paraffins, and had only the marsh gas to deal with, and knew approximately the amount, they could put in nearly the quantity of oxygen required to combine with it. With reference to Mr. Foster's remarks, he was quite sure that, having made a large number of gas analyses, he must have come across the same difficulties as he had himself.

## THE ANALYSIS OF THE PRODUCTS OF INCOMPLETE COMBUSTION.

In his opening remarks in the second paper, Professor Lewes said that the methods of analysis which served to separate and estimate the constituents in an ordinary gas failed altogether to detect the presence of minute traces of such gases as methane, hydrogen, acetylene, and carbon monoxide when mixed with large volumes of inert gases such as nitrogen; and moreover as these four gases offered great difficulties of separate estimation by any combustion processes at present in use, the determination of them in the products of incomplete combustion escaping from flames which were used for heating cold surfaces, had hitherto proved unsuccessful. Alluding to the paper read at the last meeting of the British Association on the products of incomplete combustion of gases given off from gas-stoves,* he said that the author (Mr. W. Thomson) endeavoured to separately determine the quantity of carbon monoxide and hydrocarbons in the flue gases; but, like most other observers who had tried to do this, he found it so beset with difficulties that he abandoned the attempt, and contented himself with determining the total quantities of carbon and hydrogen escaping in an unburnt condition. The experiments showed that the combustion of gas in stoves had been far less complete than had been imagined; but unfortunately they gave no idea as to whether the carbon and hydrogen were present with the products of combustion simply as such harmless constituents of the gas as methane and hydrogen, or whether they were there as the highly-poisonous products of incomplete combustion—acetylene and carbon monoxide. For some time past the author had been trying to utilize the well-known property which palladium had, of causing the oxidation of hydrogen (but not of methane) when a mixture of these two gases with air were passed over it as a separation between them. The carbon monoxide present, however, would have been a difficulty in the way of doing this had not experiments shown that it was oxidized to the dioxide under the same conditions as brought about the oxidation of hydrogen when passed over heated palladium asbestos. It was necessary to try by experiment whether, during the slow passage of a large volume of the products of combustion through a heated tube containing a considerable quantity of palladium asbestos, a satisfactory combustion of the carbon monoxide and hydrogen could be obtained, without at the same time interfering with the methane present, as, if so, the acetylene could be absorbed first of all in the usual way by ammoniacal silver nitrate, the carbon monoxide and hydrogen estimated by combustion in contact with palladium asbestos, and the methane determined by further combustion in contact with platinized pumice.

Having described the manner in which the palladium asbestos and the platinzed pumice stone were prepared, Professor Lewes referred to the methane, carbon monoxide, and hydrogen used. The percentage of true gas in each of these was carefully determined, and a mixture was made containing 3·60 per cent. of hydrogen, 71·31 per cent. of air, 20 per cent. of oxygen, 4·30 per cent. of methane, and 0·79 per cent. of carbon monoxide. This mixture was confined in a carefully graduated glass bell jar over water; and after being carefully freed from any trace of carbon dioxide, by passage through caustic potash, and dried by calcium chloride, it was passed through a small combustion tube (10 inches in length) containing the palladium asbestos, heated by three spirit lamps placed 3 inches below it, the carbon dioxide and water so produced being collected in a series of absorption tubes, giving the carbon monoxide and hydrogen present in the gas. The residual gas passed on over the platinized pumice, heated to a high temperature by a series of Bunsen burners; the products of combustion being collected in another set of absorption tubes. Three analyses of the mixture

* See Journal, Vol. LVI., pp. 602. 996.

gave the following results, which were not considered to be very satisfactory:—

| | | I. | II. | III. | Actual. |
|---|---|---|---|---|---|
| Hydrogen | | 3·00 | 3·84 | 3·28 | 3·60 |
| Methane | From ($H_2O$) water | 4·70 | 5·00 | 5·19 | 4·30 |
| | From carbon dioxide | 3·95 | 3·82 | 3·47 | |
| | Mean | 4·32 | 4·40 | 4·33 | |
| Carbon monoxide | | 0·30 | nil | 0·58 | 0·79 |

The mean of the methane, the author pointed out, agreed fairly well; but the hydrogen and carbon monoxide results were unsatisfactory. He then tried other experiments, in which he varied the distance of the spirit-lamp flames from the tube containing the palladium asbestos; and it was shown that, up to a certain degree, increase of temperature gave greater accuracy in the results. When, however, the heat was too strong, traces of methane were decomposed, and made the carbon monoxide and hydrogen results too high. Therefore he thought it was evident that, in order to obtain a reliable process of analysis, means must be taken to accurately regulate the heating of the palladium asbestos; and this was done by bending the tube containing it into V-shape, and heating it in a bath of melted paraffin wax. After many experiments at various temperatures, the author found that 210° to 220° C. gave the best results. For example—

| | Taken. | Found. |
|---|---|---|
| Hydrogen | 1·83 | 1·83 |
| Methane | 1·71 | 1·76 |
| Carbon monoxide | 1·50 | 1·47 |

Having obtained a reliable method for analyzing small traces of these gases, the process was employed for determining the composition of the gases escaping into the atmosphere when the flame of an atmospheric burner was brought into contact with the bottom of a vessel which was kept cool by water between the temperatures of 0° C. and 100° C. No flame was in contact with the substance which it heated unless the latter was at the same temperature as the flame itself. This was due to the fact that the substance being heated, by conducting away the heat from the flame, practically played the same part as the gauze of a safety-lamp, and so cooled down the flame that the ignition point of the gas was not reached in the immediate neighbourhood of the heated surface. The flame was thus extinguished for a certain distance from the bottom of the vessel; and the extinguished flame gases crept along the cooling surface, and finally escaped into the air.

After a number of attempts to devise a form of apparatus which would allow the products of combustion to be collected without at the same time giving too great an admixture of air or interfering with the process of combustion going on, the author arrived at the conclusion that the best form of apparatus to use was a tin-lined copper pot. A specimen of this apparatus was exhibited; and Professor Lewes proceeded to describe it. The bottom of the pot, he said, had a false bottom, which gave a space of an inch between the two bottoms. In the centre of the false bottom was an aperture 2½ inches in diameter; and fitted into the side of the lower compartment was a ⅛-inch exit-tube. Putting a known volume of water at 0° C. into the vessel, and placing a Bunsen burner with a flame of carefully regulated size below it, so as to allow the flame to pass through the hole in the false bottom, and impinge on the bottom of the vessel itself, it was possible to draw off products of combustion from the exit-tube without having a larger volume of air than necessary mixed with it. On leaving the tube, the gases were passed through fused calcic chloride, which had been previously treated with carbon dioxide, to prevent any free alkali being present; and the increase in weight of these tubes gave the water vapour produced by the combustion. The gas then passed on through tubes containing caustic potash to absorb carbon dioxide, and then through a tube in which a sample could be taken for determination of the oxygen; while the acetylene was next estimated by passing the gas through two absorption flasks containing ammoniacal silver nitrate. Next came the palladium asbestos tube heated to 220° C. in a paraffin bath, and the U-tubes containing the calcic chloride and caustic potash for estimating the water vapour and carbon dioxide formed. Then followed the platinized pumice heated by a flat-flame burner nearly to the softening point of the combustion tube. Beyond that was a trap-tube of calcic chloride. And, lastly, aspirating vessels. In these, the volume of gas sucked through could be measured; and after correcting for temperature and pressure, the volume of gas absorbed in the experiment could be added—giving the total volume of products of combustion drawn through. With this apparatus the author tried an experiment on a mixture of known composition, which showed that an excess of oxygen must be mixed with the products of combustion in order to give satisfactory results with low forms of combustion as those taking place in the palladium asbestos tube; and a carefully measured quantity of pure oxygen was then made to flow in at a steady rate to the second acetylene absorption bottle, so as to mingle with the products of combustion before passing over the palladium asbestos—the gas being kept in a carefully graduated glass bell-jar, so that the volume used could be abstracted from the total volume of gases after correcting for the amount used in the various combustions. In this way, the products given off when the vessel was heated at a point ½ inch above the inner zone of the flame, and also the top of the flame, were determined. The results of this experiment were given in a table included in the last of the series of Cantor Lectures delivered by Professor Lewes at the Society of Arts in December last.* The figures showed that the extreme tip of the atmospheric burner was the only portion of a flame which could be utilized for heating substances cooler than itself without giving rise to deleterious products of incomplete combustion. These results were corroborated by analyzing the gases escaping unburnt from the outer zone of a luminous flame and an atmospheric burner flame respectively. The figures arrived at by the author in these analyses were also given in the lecture mentioned above; and they showed that the air mixed with coal gas in the atmospheric burner produced far more complete combustion than in the case of a luminous flame. He also quoted the results that Dr. Blochmann obtained in experiments upon the composition of gases present in various parts of the Bunsen flame; and these were likewise embodied in the lecture previously referred to. They tended to show that the flame of an atmospheric burner could not be used for any heating purposes without the escape of deleterious products, except at the extreme tip where combustion was completed. Therefore in all forms of gas-heating apparatus, it was the hot products of combustion and not the flame itself which should be employed as the source of heat, unless thorough ventilation could be obtained and none of the gases from checked combustion were allowed to find their way into the atmosphere of the room.

In the course of the discussion,

Dr. Thorne said that the members were grateful to Professor Lewes for having brought before them the interesting results contained in his paper. The subject was of immense importance, and perhaps more so at present than it had ever been, when the use of gas for heating purposes was becoming so much extended, and, if one could judge by experience, would become still more extended in the near future. This question of incomplete combustion was one of the most serious points in the use of gas as a heating agent. He supposed there were very few—he might almost say no heating-stoves at present in use that were perfectly innocent in this matter. The greater number of heating-stoves that were sold were simply abominable. The prejudices against using gas as a heating agent were to a large extent due to the fact that the question of incomplete combustion had not been sufficiently recognized; and manufacturers of stoves had taken no account whatever of the conditions that should be carried out to produce stoves free from danger and contamination of the air of the rooms in which they were used. He thought Professor Lewes's results were most interesting; and the apparatus he had employed in his experiments was admirably suited to the work he had been performing. He had obtained an analysis of the products of combustion on the surfaces of the flames in a way that had never been carried out hitherto, and had been able to differentiate the products of the different parts of the flames by a plan which would be of great importance.

Mr. Bertram Blount pointed out that Professor Lewes had not given them any data in his paper on which to comdemn gas-stoves. If he could give them an analysis of gas drawn from the neighbourhood of the flames in thoroughly well-made gas-stoves or any other form of heating apparatus—if he could give them an analysis of the gas given off at the point where the Bunsen flame played upon a refractory substance—then they would be able to say whether gas-stoves did or did not incompletely burn the gas. Besides there was this little difficulty in his experiments—in order to collect the gases, he had recourse to the device of a false bottom. He did not know that a better plan could have been adopted; but it appeared to him that, even with the careful regulation that the author had spoken of, there must be some mistake in checking the combustion, and the Bunsen burner would consequently show up worse than if it were burning freely without any such restraining influence.

Mr. Lacey said he should like to confirm what the last speaker said as to the great importance of the method in which the products of combustion were collected. If the flame was at all affected by the casing—as he certainly thought it would be—it must limit the amount of air that would pass under ordinary conditions; and, of course, this meant that the results were not exactly what would be obtained if the gas was burned under a copper pot in the usual way. The same objection applied to some extent to the difficulty of collecting gas from any flame if its normal action were interfered with. He knew that the difficulties were very great; and he could not but say that the author had exercised every care he could be expected to do, in order to avoid errors. He thought it was possible that the normal action of the flames had been interfered with by the method of collecting the products of combustion. Professor Lewes had shown them a method by which they could analyze these gases, and which could be applied by anyone who had a knowledge of chemistry. It would have been very satisfactory if it had been possible to test the actual products of the combustion of the flames (say) from a gas-stove; and given an analyses of them.

Professor Foster said that the subject before the meeting was of the greatest importance at the present time, seeing that there was such an enormous development in the use of gas for heating purposes. Now what was the condition of things (say) in the case of the effluent gases coming out of the cylinder of a gas-engine. The condition of things was briefly this—that, if the gas was in course of combustion, whether there was oxygen in

* See Journal, Vol. LVI., p. 1336.

excess or not, it was of little moment, if the flame was surrounded by a cold substance. The matter with which they were dealing was brought under the notice of Mr. Dibdin and himself at the exhibition held a few years ago at the Crystal Palace; but it was a matter of regret that they had not then an opportunity of investigating it. The nature of the mixtures of course determined what the nature of the effluent gases would be. The more hydrogen there was in the mixture, the less would be the carbonic oxide produced.

Dr. WRIGHT said there was one point which occurred to him. Various forms of stoves were in use in which the products of combustion came in contact not with fire-clay, but with iron, which became coated over with a film of oxide. He could not say he had carried out any very extended observations, but what observations he had made led him to believe that much more perfect combustion was obtained with this surface than when the flame played on clay or such-like material. With reference to the table showing the gases escaping during checked combustion, he asked what had become of the oxygen which was associated with the nitrogen in the air.

Professor LEWES said the oxygen was estimated from the amount taken out of the tube, and the amount of nitrogen belonging to it as air was deducted so as to give the products of combustion without mixture with air. The oxygen was analyzed; its proper quantity of nitrogen was then deducted from the total nitrogen found; and this gave the amount of nitrogen and hydrogen left. The proposition as to heating iron with flame, he had not had an opportunity of judging; but it sounded very reasonable indeed. Dr. Thorne, who opened the discussion, treated him (Professor Lewes) very kindly, but the gas-stove manufacturers, he thought, a little harshly. The whole trouble was this: In order to make a gas-stove which should give off merely harmless products of combustion, only the extreme tip of the Bunsen burner should be used if the highest results were required; but if they were to ask a gas-stove manufacturer to construct a stove under these conditions, he would simply laugh at them. All the time more was expected of gas-stoves than could possibly be obtained from them, they would continue to have the noxious products given off. There was not a single gas-stove made, the products of combustion from which should be allowed to enter the room; and where gas-stoves were used, there must be perfect ventilation. Mr. Bertram Blount said that he (Professor Lewes) had not given any figures as to the heating effect of flames on refractory materials; but that was a question he was not dealing with. It did not much matter whether they heated asbestos or any substance up to the point of ignition; in every case these products of incomplete combustion would be given off. As the temperature rose, the percentage of incomplete products, however, became less Mr. Lacey made an admirable remark as to the limitation of combustion such as must take place in a vessel like that used in the experiments. This was a difficulty which was present in his mind; but he thought Mr. Lacey would find that the products were not so much increased as might be expected. In the experiments, he used a small flame, so as not to fill up the hole in the false bottom. There was thus a free space round the flame; and therefore the interference with it was as small as one could well get.

A vote of thanks was passed to Professor Lewes for his very instructive papers.

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**Messrs. J. and W. Wood,** who are large proprietors of collieries in Cumberland and Scotland, have extended their operations into Monmouthshire; having bought the Glyn Pits at Pontypool.

**A Gas-Balance with a Compensator.**—According to the *Zeit. für Anal. Chem.*, MM. A. Siegert and W. Durr have devised a gas-balance which differs from that of Herr Lux in the fact that the hollow sphere suspended to the weigh-beam is closed and filled with air.

**A Standard for Cast-Iron Pipes.**—A Committee appointed last year by the American Water-Works Association to prepare a standard specification of cast-iron pipe have issued their report. As regards the quality of iron used, the Committee consider that this should be ascertained by transverse rather than tensile tests. The difficulties met with in water-pipes arise, they state, from (1) a poor quality of iron; (2) shrinkage in the metal, due either to improper moulding, varying thickness of shell, or too rapid cooling; (3) want of uniformity in the thickness, which is usually due to bad moulding. The second cause of trouble is, they consider, the most important; and to it they attribute the bad name cast iron has as a structural material. Difficulties arising in this way can be avoided by insisting on the metal being properly cooled before removal from the flask. The hydraulic test of pipes should, they hold, be supplemented by the hammer test while the pipe is under pressure, though even when this is done a pipe which has satisfactorily passed both these tests has been known to burst some months later when laid under a pressure much below that of the test, and without there being the slightest sign of water ram or flaws in the metal. This, the Committee think, must have been due to bad treatment of the pipe in the foundry. The test pressure should be 300 lbs. per square inch for all pipes less than 12 inches in diameter and 250 lbs. per square inch for those above this size. The third cause of trouble—viz., want of uniformity of thickness—can be avoided by calipering. Any pipe varying 10 per cent. in thickness, either more or less, should be rejected.

## INFORMAL MEETING OF SCOTCH GAS MANAGERS.

The Eighth Annual "Informal" Meeting of Scotch Gas Managers was held last Friday in the Waverley Commercial Hotel, Glasgow. The circumstances under which these meetings were originally projected and are carried on have been fully explained on previous occasions. There is no Council or organization of any kind; but Mr. J. M'Gilchrist, of Dumbarton, has been constituted a sort of perpetual Convener. For the present occasion he secured as Chairman Bailie R. Robertson, of the Bathgate Gas-Works, President-Elect of the North British Association of Gas Managers, who was supported by Mr. J. Hepworth, M. Inst. C.E., of Carlisle, President of The Gas Institute, Mr. J. M'Gilchrist, Mr. A. M'Pherson, of Kirkcaldy, and Mr. R. S. Carlow, Secretary of the North British Association of Gas Managers. There was an unusually large attendance of gas managers and other gentlemen connected with the gas industry.

Bailie Robertson, on taking the chair, at once proceeded to deliver a short address by way of initiating the informal work of the meeting. Having expressed his thanks for the honour conferred upon him by placing him in the position he then occupied, he went on to remark that those present would doubtless all look back with pleasure and satisfaction to their former discussions in that place; and he hoped that the meeting on this occasion would prove as interesting and profitable as its predecessors had been. They were certainly very much indebted to their worthy and energetic Convener, Mr. M'Gilchrist, for resuscitating the West of Scotland Association of Gas Managers, and carrying it on in its present form; the chief characteristics of that Association being the friendly feeling that existed, and the unrestricted endeavours they made in giving one another the benefit of their experience. It would appear that the want of formality led to more freedom in the interchange of thought and ideas; and he trusted that they would have not a few practical hints thrown out by those present, who were fully charged with long and varied experience in the "ins and outs" of the gas profession. It seemed to him that these "informal" meetings were of more practical value to the managers of small gas-works than the gatherings of the larger Associations, where papers were, as a rule, of an advanced and technical nature, on account of which many persons were kept back from entering into the discussions; for, although they were theoretically conversant with the most modern appliances that their brethren in larger establishments had opportunities of working, they feared that their remarks would lack the power which accompanied one when talking on a subject of which he had some practical knowledge. In meetings like the present, they had no special programme drawn up; and their remarks were not confined to any particular topic. They might speak of any branch of their work, of any of the difficulties they had met with during the past winter, and how they had overcome them. They might tell of the difficulties they still encountered, so that suggestions might be given as to how they could be removed; and should any of them have adopted new modes of working that had proved satisfactory, they were invited to make them known so that all might reap benefit therefrom. Any winter's work of a gas manager was fraught with considerable anxiety; but he believed the winter that had just passed had brought with it more care and anxiety than had ever previously been experienced by any of them. The labour troubles, the high price of coal, and the railway strike had affected them all round; while here and there the harassing burden had been increased on individual managers by serious accidents—those which came home to most of them being the disasters at the Middlesbrough and Dawsholm Gas-Works and the Govan Iron-Works. The one at Middlesbrough affected them because the Manager there—Mr. David Terrace—was so long associated with their meetings in Scotland; and the others, because they happened so near their own doors. The explosion at the iron-works was the most serious of all, on account of the loss of life by which it was accompanied. They all remembered the kindness shown to them, on the occasion of their last meeting, by Mr. Millen, the Manager, in conducting them round the works under his charge; and the news that he was one of the victims of the explosion would, he had no doubt, give rise to feelings of the deepest regret in the mind of every one of them who experienced his kindness last April. These events would tend to make the winter of 1890-91 ever memorable.

Proceeding from these matters, the Chairman remarked that it would be interesting to have the experiences of managers during the last few months narrated, particularly those obtained during the railway strike—how each contrived to keep up or eke out his coal supply. With regard to the labour troubles, Scotch managers had not been so directly affected by them as some of their brethren in the South, although in some places pressure was brought to bear on gas workmen, by outside agencies, to combine in a general strike with the railway men. Fortunately, the efforts in this direction were unsuccessful. He thought there was less cause for the paid agitator to stir up strife between masters and men in the gas industry than in

others he knew of; for, as a rule, the relationship between manager and men was of a pleasant kind. The former looked upon the works as his home, and the workmen as his family; and he was always ready to remedy any grievance that might occur. So long as they could retain this relationship, taking an interest in the men under their charge, he was certain that the proposed Boards of Conciliation would have no work from them. What they had to fear most were those labour troubles that occurred outside gas-works which affected their industry, more especially that of the miners who secured their coal, and the railway men who conveyed it to their works. But there was not much to fear even from these sources in the immediate future—certainly not from the railway men, now that their cause had been lost; and with regard to the miners, should the Eight-Hours Bill become law, it would make but little difference in Scotland, for they had had this practically for two years. The majority of the miners in Scotland during this time had worked rather within than beyond the eight hours per day; and they likewise took off an additional full day every week. The result of this restricted labour had added considerably to the advance in the price of coal; and now that the blast-furnacemen had resumed operations, and the demand for coal had still further increased, they might look for another rise. The increasing cost of cannel was of momentous importance to gas managers, who were brought face to face with the alternative of either lowering the illuminating power of their gas by the use of poorer coal, or finding some mode of enriching the gas obtained from that poorer kind of coal—some mode that would give gas of as great permanency and high illuminating power as they now obtain from cannels, and at less expense.

The Chairman next thought it desirable, in the few remarks he had still to make, to direct the attention of managers of small works to the benefits to be derived from the erection of scrubbers and exhausters. He was anxious to do this because he had himself experienced their benefits, and had noticed that a large number of the smaller works were still without these important appliances. Doubtless this was because the profits to be derived from their use had never been sufficiently placed before them, or had never been thoroughly understood. He wished to point out that the erection of scrubbers and exhausters was not useless expenditure for small works, but a source of income. Some nine years ago there had been erected one of Young's washer-scrubbers at the Bathgate works; and the expenses of its erection were very nearly covered in one year's working. Including the connections, the total cost amounted to £65. In the year's working there was an extra yield of 10,000 gallons of ammoniacal liquor, together with a great saving of lime; and the purifying account was thus brought down to rather less than ¼d. per 1000 cubic feet of gas. The 10,000 gallons of liquor, at 10s. per 100 gallons, amounted to £50; and the saving of four tons of lime, at 10s. per ton came to £2—thus making a total revenue, for one year's working, of £52, or not much short of the total cost. The price of liquor was not so high now as it was then; but it was still high enough to warrant any gas company in proceeding with the erection of such a scrubber. He considered it to be unnecessary for him to explain the construction of the appliance in question, as this had been done by the patentee, and by the late Mr. Scott, of Falkirk, at the North British Association meetings; and the description could be found in the records of the Association. With regard to exhausters, he believed that his works at Bathgate were the smallest in Scotland that had one; but notwithstanding their limited capacity, the exhauster, working for six months of the year, showed a gain of 15 per cent. on the cost of its erection. The total cost of the exhauster, engine, boiler, and connections was £230; and the extra quantity of gas drawn off, amounting to something like 500 cubic feet per ton of coal carbonized, produced a yearly profit of from £34 to £35, besides the saving of retorts through the reduction of carbon deposit. The gain was not so great as that obtained from the scrubber; but it was sufficient, he thought, for the serious consideration of all gas-works managers. The make of gas exceeded 5½ or 6 million cubic feet per annum.

In drawing his remarks to a close, the Chairman said that he did not wish to trespass longer on the time of the meeting. His object had been to make a very short introductory speech by way of opening the proceedings; and now that the ball was set rolling, he hoped it might be kept going until the time for discussion was exhausted.

The address having been prepared specially with the view of uggesting topics for discussion, advantage was freely taken by a number of gentlemen to make remarks.

Mr. Hepworth said the meeting was the first "informal" one he had ever been at. He had long wished to know what such a meeting really was; and he hoped to have his desires satisfied before the day was done. Referring to the Chairman's remarks regarding the troubles of the past season, he felt with him that they were almost unique. He (Mr. Hepworth), although not actually living in Scotland, had also had his own difficulties over the Border; for he was, during the Scotch railway strike in the depth of winter, within 24 hours of being absolutely without cannel such as would enable him to produce gas of 20 candles. As he was not able to get it from Scotland, he obtained it from the South. He had a railway siding into his works; and he had a locomotive which he lent to a neighbour. By so doing he obtained a supply of coal to meet his immediate requirements; but in the eyes of the railway men at Carlisle he became a "blackleg." He hoped, however, that he might be forgiven. As to the prospective high price of cannel, of which the Chairman had spoken, the news might be comforting to the coal proprietors, but it was by no means cheering to him as a gas manager; and he hoped the Chairman might prove to be wrong in his prophecy. But if the price of cannel were to rise much higher, he was satisfied that they would be obliged to resort to one or other of the alternatives suggested in the address; neither of which courses, however, did he think was desirable. There was, it was true, a third alternative, which was to raise the price of gas; but, in view of other cheap lighting agents, he did not think it was well to have recourse to such a remedy. Referring to the question of the relations between employers and employed, he said he was glad to hear from the Chairman that there was no need existing in gas-works for conciliation boards. His own opinion, however, was that the friendly feeling which formerly existed in their works had been somewhat disturbed of late; and he feared that gas managers might find that their workmen were not wholly outside the influence of the paid agitators—men whose business it was to stir up strife. Mr. Hepworth cordially supported the views of the Chairman in respect of the equipment of small gas-works. Scotland had always been ahead of England in regard to the erection of scrubbers and exhausters; but still it was a marvel to him that they had not been more largely introduced into the small gas-works. He quite concurred in the remark in the address as to having such appliances in works where the annual make of gas was as low as 5 million cubic feet; and he would even include works having a make of only 3 million feet. Alluding to an instance within his own experience, he remarked that some eighteen or twenty years ago he had had something to do with a small works in Scotland, and had been the means of introducing a washer and a scrubber, both of which, however, had fallen out of use. It was absurd to think of small works not using such appliances. He went on to refer to the case of small gas-works that were far away from tar-distilling establishments disposing of their tar and liquor to advantage, and suggested that such works might be established for certain districts of the country on the co-operative system.

Mr. John M'Crae, of Dundee, said that he had derived much pleasure and instruction by attending meetings like the present. There was much propriety in gas managers coming together and getting their difficulties stated; but hitherto there had been too much reticence among them. Managers had got through the difficulties of the past winter, which had not by any means been small. There had been the strike difficulties; and those of the speaker had been equal to Mr. Hepworth's. He was glad to be able to say that the coalmasters had stood by the gas managers, and kept them out of danger. But the prospects were not bright in respect of the price of coal, the rise of which must come to an end. A huge mistake was being made in regard to rich Scotch cannels. He could not see why such coal should be sent abroad and not be available for use in gas-works at home—indeed, in this matter he considered that there was something radically wrong which ought to be rectified, or else they would have to resort to the use of oil for the manufacture of gas, reduce the quality of the gas, or make a higher charge for it. Speaking of the equipment of small gas-works, he said that in his opinion, there was no good reason why every modern appliance should not be obtained for a small as for a large works—for one supplying a population of 15,000, as for one furnishing gas to a town of 150,000 persons. The same principle should be adopted in both kinds of works in regard to scrubbers, exhausters, &c. Referring to the papers submitted to the meetings of Gas Managers' Associations, he urged that those managers who were supposed to be outside the "inner circle" should make it a point of duty to prepare papers embodying the experience gained in their respective works, so as to secure that all questions of difficulty might be ventilated in the company of other managers for whom they might rely on obtaining advice. In regard to Mr. Hepworth, he expressed his great pleasure in seeing him present. He well remembered visiting his works at Carlisle about twenty-one years ago, and being very kindly received by him; and he hoped that that gentleman's visit to Glasgow might have the effect of bringing more Scotch gas managers into the membership of The Gas Institute, so that they might get into closer touch with it; for he did not think that under the new *régime* it had lost any of its prestige.

Mr. Henry Aitken, of Falkirk, speaking as a coalmaster, and referring to the "third alternative" which had been spoken of, said that they would have to face the difficulty as to the increase in the price of cannel. The coalmasters had for the last ten or fifteen years been working at a loss, or without profits, while proprietors of gas-works had been getting good profits. They must now do with less profit. He (Mr. Aitken) put the position of affairs very plainly and bluntly. The cannel was wanted by the foreigner, who was willing to pay the price asked; and whoever was prepared to pay the biggest price would certainly get the cannel.

Mr. R. Mitchell, of Edinburgh, in dealing with the question of the quality and price of gas, said that the general public had the matter in their own hands. He referred to the recent experience in Edinburgh, stating that he had been instructed to produce 27-candle gas; and, as a matter of course, the consumers must pay the necessary price for it. Then, as

to scrubbers, exhausters, &c., he had no hesitation in saying that every available improvement should be introduced into small gas-works as well as into large ones.

Mr. D. Robertson, of Dunoon, held that there was as much ability needed in managing a works supplying a population of 15,000 as one providing gas for 150,000; and he referred to his experience in the works under his charge. He had been much benefited by having a scrubber; and he had been able to prevail upon his Directors to go the length of getting an exhauster. It had enabled him to produce 800 to 900 cubic feet of gas per ton more than formerly, and this was equal to a return of about 20 per cent. upon the outlay. Unlike the Chairman, he used his exhauster nine months in the year; and he would not now care to be without it.

Mr. D. Vass, of Portobello, in a few remarks, alluded to the difficulty of dealing with the tar made during the railway strike; and on the question of obtaining coal during that period, he said he had been able to get his supplies direct from the pits by carting it.

Mr. A. MacPherson, of Kirkcaldy, was of opinion that the topics for discussion indicated in the Chairman's address had been well thrashed out. He would himself, however, bear out what had been said regarding the propriety of equipping small gas-works with such appliances as had been mentioned. He had himself put them into small works; and they had yielded exceedingly good returns. In his opinion, even more ingenuity was frequently displayed by the managers and engineers of that class of works than by those having charge of large ones; and the greater the efficiency of the management, and of the appliances in use, the greater was the profit. As they accomplished their returns frequently on very limited means, the managers of small works deserved to be highly commended for them. As to the railway strike, he stated that he had not been ill-off during its continuance. Fearing that it might be of some duration, he began to "yell" at the beginning of it; and he succeeded in getting a sufficient supply of coal. The coalmasters were certainly deserving of much commendation for the strenuous efforts which they put forth to meet the difficulties with which gas managers were confronted; and the same might be said of the railway companies.

Mr. Gavin Paul, of Edinburgh, dealing with the coal question, said he was not ready to agree with those speakers who desired that the price of cannel should fall. His opinion was that the value of cannel, as of any other commodity, was what it would bring. He also remarked that gas managers had encountered and overcome much more serious troubles than the high price of cannel; and they would also overcome that difficulty.

Mr. M'Gilchrist, of Dumbarton, like Mr. MacPherson, thought that the other subjects for discussion had been sufficiently well thrashed out; and he suggested that the Dawsholm explosion might be spoken of, as it would be highly interesting to gas managers to know how and from what cause it took place. His opinion was that dynamite had nothing whatever to do with it. There was a great desire on the part of practical gas managers to learn what the real cause was; indeed, he believed that the cause was well known. Another matter that he would refer to was the desirability of having abundance of room for storing coals. All gas-works were short on this score; while in some cases managers had to be content with a week's, or, at most, a month's stock of coal. Storeage for two or even three months' supply was really needed. All managers ought to have ample storeage, so as to be able to get in supplies of coal during the summer or autumn. By doing so, they would help the railway companies to provide against such difficulties as arose during the strike.

Mr. J. M'Crae alluded to the question of Trades Unions, and said he was not disposed to denounce them. He was of opinion that, if the men whom they employed had any grievances, it was the business of the employers rather to anticipate the men's demands than wait till they were forced to consider them by the action of the men. There had been great difficulty with gas stokers; but he would like to have the moral tone of the men, and their relations with their employers, raised. He held that a day of eight hours was long enough for stokers to be employed, considering the severity of their labour, and the circumstances to which they were exposed, even though their work was not continuous during the whole of the shift. A Sunday shift of eighteen hours was far too long; his men in Dundee were never on duty more than twelve hours on Sunday. Mr. M'Crae mentioned what had been done for the comfort of the men under his charge; and urged that even though it cost 1d. per 1000 feet on the price of gas to make the men comfortable as to warm baths, &c., it should not be grudged. Employers should be the first to endeavour to bridge over the difficulties which were liable to arise with their workmen.

Mr. R. S. Carlow, of Arbroath, mentioned some interesting experience of his as to works' appliances both at Port-Glasgow and at Arbroath. He also gave an interesting account of the way in which he had managed to have his coal supply maintained during the strike—a matter which was referred to in the JOURNAL at the time. Of course, he had to content himself with inferior coal, which had yielded less gas and of lower illuminating power than was customary; and consequently he had had to employ more labour to deal with the extra quantity of coal used. His men had eight-hour shifts; and they were pleased with them.

After some other speakers had "delivered" themselves on these several topics, Mr. M'Gilchrist referred to the Bo'ness explosion (of November, 1889), and what he considered was a wrong decision given by the Court of Session regarding the legal action to which it gave rise. He urged that gas companies and corporations should take up the matter, and carry the case to the House of Lords. Several of those present spoke on the subject, including Mr. Napier, of Crieff, Mr. MacPherson, Mr. Aitken, Mr. M'Crae, Mr. Mitchell, and the Chairman; but no definite result took place at the close of the discussion.

A vote of thanks was passed to the Chairman for his address; and, on the motion of Mr. M'Gilchrist, it was agreed to ask Mr. T. D. Hall, of Montrose, to preside at next year's "informal" gathering. The best thanks of the meeting were also awarded to Mr. M'Gilchrist for his services as Convener.

A dinner subsequently took place, Mr. Robertson presiding.

## NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

### The Twenty-First Annual Meeting.

(*Continued from p. 646.*)

A paper on "Unaccounted for Gas," written by Mr. L. P. Gerould, was read by the Secretary. The writer put a rather wider construction on the term than is generally applied to it, and regarded it as the difference between the actual sale and that which is possible under the best management. This he took as 11,200 cubic feet per ton of coal carbonized. Leakage from the retorts, due to improper setting, was, he said, the cause of a large amount of loss. Only men expert and experienced at retort-setting, should be employed; and the new work should be allowed to heat up slowly. Before working, it should be tested by closing the damper, and introducing into the furnace a few shovelfuls of coke screenings mixed with tar. The dense smoke thus produced would pass through the cracks (if there were any), showing their position; and they could then be stopped with good cement. The retorts should be kept properly clean, and free from excess of carbon, and all cracks filled as soon as detected. The mouthpiece joints frequently leaked. This was due to rust or dried tar left on the flange; and it applied to joints of all kinds. However carefully the cement or gaskets might be prepared, if the iron surfaces were not clean there could not be a tight joint. The author always rubbed the iron smooth and clean with a piece of sharp soft sandstone, and thus secured joints that could be depended upon. Stopped ascension and H pipes were also a cause of loss. As a remedy for this, and also for pitch in the hydraulic main, the use of a combined open and closed dip-seal pipe, in place of the ordinary dips, was recommended. The use of tar-coated pipes, or of tarred yarn for making joints in laying mains, was deprecated, for the reasons above indicated. The State Inspector's reports of meters tested were objected to as not giving a fair idea as to their working. They only represented the fast meters, because people did not complain about meters that were slow. Every company, however small, should use a meter-prover, and test every meter at least once in five years.

Mr Neal began the discussion by saying he was troubled with a large leakage account. He had heard of companies who only lost 2¼ per cent.; but although he had taken a good deal of trouble, he could not bring his own loss below from 10 to 12 per cent. He did not think the station meter was at fault, either in respect to registration or the temperature of the gas. When he read of companies losing 20 per cent. or more, he was puzzled to know where the gas went without being detected by the smell. Mr. Nettleton mentioned the case of an engineer of a gas-works who for several years kept a register of the temperature of the gas at the station meter, and also at the meter at his own house. The difference between the two averaged 20°; and this would, he said, account for leakage to the extent of 4 per cent. By continual watchfulness, patience, and perseverance, it would be possible to get down to nearly this limit. Mr. Jones agreed that the exercise of constant vigilance was the best way of keeping down the leakage; and he recommended a regular, systematic inspection of the mains, and the keeping of accurate records of the results. The cause of the leakage being greater in one part of the district than another could thus be soon ascertained. Mr. Slater recommended the careful testing of all pipes before laying; and he said he agreed with the writer of the paper in considering that untarred jute packing-yarn and the best Roman cement were the best materials for making the joints of mains. He considered the consumers' meters to be the cause of a great deal of the so-called leakage. Mr. Gifford suggested that the burners in the street lamps frequently passed more gas than they were rated at, and this constituted a source of loss.

Mr. C. D. Lamson followed with a paper entitled "Note-Books: Their Value and How to Keep Them." He said the subject was suggested to him by the the paper on "The Gas Engineer and his Pencil," presented by Mr. Shelton at the last meeting of the American Gaslight Association;* and he highly approved of everything contained therein. It had been said that one cause of the rapid advancement of the electric light is the large number of trained and educated young men who are going into it. Others urged that an intelligent, hard-working

* See JOURNAL, Vol. LVI., p. 1293.

practical man would do as well as anybody else for the work. Possibly the technical graduate might not have sufficient energy and push, or might be afraid of soiling his hands or his clothes, and therefore be placed at a disadvantage as compared with a quick, intelligent hard worker who was not afraid of a little tar. Other things being equal, the technical training would teach a man how to apply his energy to the best advantage; but the self-made man, who had gained his position by industry, intelligence, and faithful service, need not be discouraged by his want of education, for he could do a great deal to remedy it. A few hours a week might be devoted to the study of chemistry. Lessons, either private or at a technical school, on this and other subjects, could be had at a small expense. The principal advantage of a good scientific education was the habit it introduced of keen observation, careful thought, and recording in a systematic manner, for future reference, the facts obtained. All could learn this to a certain extent. They could become keen observers as well as careful note-takers, and could begin in their own works. They should also learn to do with their own hands everything the workmen did; and thus they would be able to tell whether or not men were working properly. For the jotting down of observed facts, a note-book with pencil, rubber, and a 2-foot rule should be carried. Entries should always be dated, and should consist of a concise record of facts, illustrated with sketches and measurements. A set of several books of uniform size and style might be employed. References to articles, tables, &c., likely to be in demand, should also be put down in the note-book. Cuttings from periodicals, trade circulars, &c., containing useful information, should be pasted in a large scrap-book. A small camera and photographic outfit would be found of great advantage. A set of photographs taken at regular periods throughout the erection of important plant—say, a large gasholder—would furnish a most valuable record of the progress of the work. He had fixed upon a note-book 5¼ in. by 8¼ in., with a marginal line on the left-hand side of the page, with guards at frequent intervals between the leaves for pasting in papers, photographs, &c. He concluded by a brief reference to the various subjects he had touched upon in his old note-books.

Discussion having been invited, Mr. Taber heartily supported the suggestion in the paper as being worthy of careful attention. Other speakers illustrated the importance of careful and systematic note-taking. Mr. Greenough gave examples of technical graduates who had come out of college, started in a gas-works at the bottom of the ladder, and had rapidly made their way up. He spoke in favour of technical examinations, similar to those conducted at the City and Guilds of London Institute.

The next paper was entitled "Repairing Gasholder-Tanks;" the author being Mr. F. C. Sherman. He remarked that in his experience tight tanks were the exception, and leaky ones the rule. All the tanks that had come under his care were more or less leaky; but he had always succeeded in making them tight. He found it was worth while to do this, even at considerable expense; because even if the water had not to be paid for, there was the cost of pumping, attendance, &c., and the risk of actions and damages on the part of owners of wells in the neighbourhood. In some cases gas-works located in thickly-populated districts had been subjected to so many lawsuits on this account that they had moved their works entirely. The old prescription for leaky tanks was bran and sawdust; and he had removed from a tank as much as 20 cartloads of this stuff. The first tank he repaired had been built for three years, and was leaking from the bottom at the rate of 2 inches per day. It was made tight by re-laying the bottom with two courses of bricks in Portland cement. In another tank the top layers had been lifted by ice and frost; and this was made good by plastering with Portland cement. A third, which had been built for 20 years, would leak at the rate of 1 inch per day down to 7 feet below the curb, and remain at this level. It was enclosed by a brick house, with 2 feet between the wall of the tank and that of the building. Rendering with cement having been tried and proved unsuccessful, the earth filling was removed down to the foundation of the house—a depth of 7 feet—when three fissures were discovered. The space was filled up with grouting; and this proved to be a satisfactory cure. In the year 1872 the New Haven Gas Company built a tank 120 feet in diameter by 26 feet deep. The excavation extended 20 feet below ground, and was in sand —6 feet being quicksand. Heavy retaining walls were put up on three sides, and on the fourth a graded slope extended a distance of 100 feet. The walls started at a thickness of 3 feet, and were gradually reduced to 2 ft. 4 in. at the curb. The gasholder-house was a continuation of the tank; starting with a thickness of 16 inches at the ground-line, and tapering up to 12 inches. Piers extending throughout the whole height were placed 12 feet apart. This tank remained quite tight for five years; but at the end of that time water was observed to be escaping at the foot of the slope, and this was traced to a crack ⅛ inch wide, extending downward 15 feet from the curb. The part of the wall adjacent to the crack was cut out and rebuilt; but this was not a success. The tank was next banded with three bands of wrought iron 6 in. by ½ in. in section, made up in 20 feet lengths, and screwed together. The spaces between the piers were filled up with solid masonry for the bands to bear upon. They were 4 feet apart, and were covered with Portland cement to prevent corrosion. The total cost was about £300; and the tank had remained tight to the present time. In 1889 he repaired a tank that had been sound for 24 years. But it began to leak; and three small fissures, extending 10 feet down from the curb, were found in it. He lowered the water, and built some heavy piers behind the cracks; leaving a space to be filled with Portland cement. Last snmmer the tank began to leak again; and it was found that the fissures reached below the piers built the year before. He banded the tank, which was 80 ft. by 20 ft., as above described; and so far this had been a success. He considered that tanks extending above groun should always be banded.

Mr. Lamson commenced the discussion by exhibiting a series of blue prints illustrating the work of repairing a gasholder-tank at Commercial Point. The tank was 176 feet in diameter by 40 feet deep, and had been emptied several times without finding the cause of the leakage. At one place the wall cracked from top to bottom; and it was supposed that the repeated pumping of water had disturbed the quicksand under the foundations. The crack was repaired by means of a coffer dam while the holder was in operation; the wall being cut out, and new bricks put in. When the tank could be spared, it was emptied; and an immense counterfort, consisting of walls 3 or 4 feet thick, running out about 25 feet, and connected by arches, was built over a length of 30 to 40 feet of the tank. An iron band 5 in. by ⅝ in. was also shrunk on the tank. This made the sides good; but the leaks in the bottom were due to tidal influences. When the tank was empty, the water at high tide would force itself in through the bottom. Valves were fixed in the usual way for relieving the under side of the tank bottom; and when these were weighted down, the weak places were found by the water welling through. When the valves were opened, the bottom would contract again, and the cracks close. But their locality had been marked; and large stone flags set in cement were put down. A thick layer of concrete was put over the whole; and the tank was now sound. Mr. Harbison also had tanks exposed to tidal influences with a rise and fall of 27 feet. One of the tanks came within 8 feet of the retaining wall of the river; and when first filled, it split from top to bottom. The ground between the two columns adjacent to the crack was dug out, and filled in with dry stonework; leaving a space about 12 inches wide, which was filled up with grouting. The tank remained good for ten years; and then it cracked at two other points. The surrounding soil was made-ground to a very large extent. At 4 feet from the curb, an iron band 6 in. by ½ in. was put on, and a 4-inch brick wall was built round the tank; leaving a space some ½ inch wide, which was filled up with cement. That was done 15 years ago; and the tank had kept tight up to the present. Another tank, 90 feet in diameter by 21 feet deep, was built in made-ground, with buildings on one side, and cellars that extended nearly 10 feet below the bottom of the tank. After a few years' use, this also cracked from top to bottom; and every expedient was tried to make it sound, but without success. It was eventually cured by a steel lining of angle-iron at the top and bottom, and by a course of bricks laid in cement over the bottom of the tank. A suction-pipe, extending below the bottom, was fixed; and thus the course of brick was kept dry till it had become thoroughly set. Mr. Amory related a curious experience with a tank subjected to tidal influence. A heavy valve, 12 inches in diameter, was fixed in the floor, to relieve the tank from bottom pressure. The tank leaked, and no defect that would account for it could be found; but at last it was discovered that the valve was not properly ground in. When this was done, the tank proved to be tight. Mr. Lamson said he had once built a gasholder-tank in marshy soil, on a plot of ground only just large enough to take the tank, and subject to continual vibration on account of an adjacent railway and a road with heavy vehicular traffic. The piles driven in to shore up the soil showed a tendency to come in on the work; and to keep them in their places he made a sort of huge wheel of timber. This was fixed in the bottom, oak planking was laid upon it, and then a course of huge granite headers was put all round the tank.

*(To be continued.)*

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**The Manufacture of Large Gas-Engines in Germany.**—In the recently-issued report of the German Continental Gas Company (an abstract translation of which will, as usual, appear in due course in our columns), special reference is made to the employment of gas-engines in large electric light installations. The report states that the Company are continually endeavouring to increase the consumption of gas, not only for heating and power purposes, but also in decreasing the cost of installation. The construction of larger gas-engines than those generally used has been already successfully commenced; and during the past year *Z*willing gas-engines of 140 effective horse power were built on the Otto principle. When the central electric light station of the Company in Dessau was built in 1886, the largest gas motor in use was of 60-horse power; but in 1889 the first gas-engine of 100-horse power, with four cylinders, was constructed. Experience up to the present time justifies the idea that the construction of gas-engines is by no means confined to small motors; but that their use is constantly in the direction of engines of greater powers, since the consumption of gas per horse power diminishes as the engines are made larger.

# REGISTER OF PATENTS.

**Producing Water and Illuminating Gas.**—Mannesmann, R., of Landore, South Wales. No. 1238; Jan. 23, 1890. [8d.]

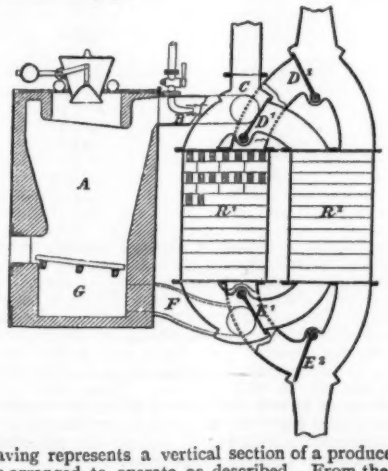
This invention relates to a process for the production of water gas by the repeated passage of a mixture of water gas and steam alternately through a store of heat and through the carbonaceous matter to be converted into water gas. In similar manner illuminating gas can be produced by the repeated passage of part of the illuminating gas produced through a store of heat to the fresh fuel.

For this purpose, for the production of water gas, a gas producer is filled with fuel; and two regenerators are placed at the side thereof (so as to communicate with the same), provided with valves, so that they may be made to communicate alternately with the producer. Assuming the charge of the producer to have been ignited, and the one regenerator heated to a high degree, while the other is in the course of being heated by the combustion of a portion of the gas made, a circulation of the gas produced is set up from the top to the bottom of the producer through the highly-heated regenerator by a steam-injector blast acting in a circulating channel. In this way a portion of the products of the producer, consisting of a mixture of water gas and still undecomposed steam will be highly heated. Thus heated, the mixture passes into the lower part of the producer, where on the one hand it gives off a portion of the heat taken up in the regenerator, while on the other hand it takes up heat from the producer by the decomposition of a further portion of the steam carried with it.

While a portion of the water gas is thus employed for transferring, by its circulation, a portion of the heat of the regenerator to the fuel, another part is drawn off (preferably from the upper end of the producer), and employed for any purpose required; while a third portion can be utilized for heating a second regenerator. When the one regenerator has become cooled down, and the other has at the same time become heated, their connection with the producer is reversed, and the operation is repeated, and so on alternately. By this means therefore a continuous current of water gas is produced; the small percentage of steam is condensed; and the entire fuel is converted into water gas, if coke is employed as the fuel. If on the other hand coal is used, the product is a mixture of illuminating gas and water gas.

In this process, by the repeated circulation of the gas through the hot regenerator, there will be used each time a certain number of calories for the reduction of the hydrogen corresponding to the difference between the temperature of the gases as they leave the regenerator and the lowest temperature of conversion of the steam in the fuel. The hotter the regenerator is, the hotter will be the steam, and the richer in hydrogen will be the gas produced. Consequently if a portion of these gases is used for heating the regenerator, the more highly will the regenerator be heated; so that at last, if a certain proportion of the gas produced is used for combustion and for heating the regenerator, no further supply of oxygen need be introduced into the generator, and the coal will be converted by the steam entirely into water gas.

While all existing methods of producing water gas suffered from the defect that only a small portion of the steam, though highly superheated, was decomposed, in the present case, says the patentee, by the repeated passage of the steam either alone or mixed with water gas, the heat absorbed by the decomposition of the steam is conveyed back to the producer, so that any admission of air to the solid fuel for effecting the combustion will be unnecessary. In this way any fuel, even of low value—such as lignite—can be converted into pure water gas and mixed with illuminating gas.




The engraving represents a vertical section of a producer with two regenerators arranged to operate as described. From the upper part of the producer A, a passage with an injector or other propeller B leads to a valve chamber C, from which, by means of a valve D¹, a portion of the produced gas is directed into one of the two regenerators R¹ R². The gas heated in passing through R¹ is directed by a valve E¹ into a passage F leading to the ash-pit G of the producer. While the gas is passing through the regenerator R¹, abstracting heat from it, the other regenerator R² is being heated by the combustion of a portion of the produced gas; the valves D² and E² being set so as to direct a current of flame or hot products of combustion through R². When R¹ is more or less cooled, and R² heated, the valves D¹ D² are inverted in position, so as to direct the portion of produced gas through R² and F to G; and the valves E¹ E² are inverted, so that the flame or hot products of ombustion can be directed through R¹ to heat it again.

**Producing Water Gas and Generator Gas.**—Von Langer, J., and Cooper, L., of Leeds. No. 4223; March 18, 1890. [8d.]

This invention relates chiefly to the means for producing an abundant supply and a good distribution of air for combustion, and for the rapid discharge of the gaseous products of combustion, in order to increase the proportion of carbonic acid during the first stage of the process, and thereby also the quantity of water gas which can be obtained from a given quantity of fuel.

For this purpose air is admitted by suction through a great number of inlets distributed over the entire circumference and height of the furnace (as described in patent No. 7252 of 1889); and the products of combustion are discharged through a stack containing an ejector or nozzle, through which passes steam, or compressed air or gas, so as to produce the necessary suction. The stack is preferably a conical cast-iron tube provided with a lid, which can be opened and closed by a lever and chain. After the temperature necessary for making water gas has been attained—that is, when the first stage of the process, or the generation of producer gas, is finished—the air-valves are closed, and steam is admitted to nozzles situated in the air-pipes, so as to blow the air contained in the air-pipe and belt, into the apparatus. After about two seconds, the supply of steam to the nozzle is cut off; and steam is admitted to the furnace through the main pipe, so as to commence the production of water gas. When the second stage of the process—that is, the production of water gas—is finished, the steam nozzels are again set in action, in order to drive the water gas contained in the air belts and pipes into the furnace, and to prevent explosion. After about two seconds again, the steam is once more cut off from the nozzle; and the first stage of the process—that is, the heating of the furnace and production of generator gas—may recommence.

**Manufacture of Gas.**—Stringfellow, J. H. W., of New Broad Street, E.C. No. 6575; April 29, 1890. [8d.]

The essential feature of this invention (to quote the words of the patentee) is "the saturation of a hydrocarbon charged gaseous fluid with vapour of water at the normal temperature of the atmosphere; or, in other words, without the addition of heat, whereby the gaseous fluid is diluted with the oxygen and hydrogen contained in the water vapour, and a gas is produced which is fixed, and which is capable of burning with a great intensity, rendering it suitable for smelting and for other purposes where great heat is required."

Fig. 1.

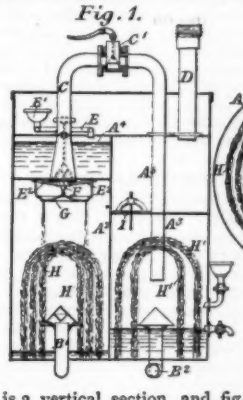



Fig. 2.

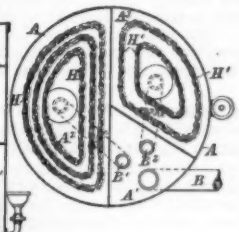



Fig. 1 is a vertical section, and fig. 2 a horizontal section, of the apparatus employed for the purpose. It consists of a vessel divided internally into three chambers—viz., an air-receiving chamber A¹, a hydrocarbon chamber A², and a water chamber A³. The chamber A² contains a liquid hydrocarbon reservoir A⁴. This is formed by dividing off the upper portion by a horizontal partition; and the chamber A³ is also subdivided by a partition so as to form the gas chamber A⁵. The air chamber A¹ is connected with a pump or blower, or with the atmosphere, by a pipe B, and also with the hydrocarbon and the water chambers A² A³, by the pipes B¹ and B² respectively, provided with suitable regulating-valves. C is a pipe which connects the chamber A² with the chamber A³; and a valve C¹, of convenient construction, is provided to regulate the flow of carburetted air to the water chamber. D is an outlet-pipe for the gas from the gas chamber A⁵ to the holder, or elsewhere, for use. The reservoir A⁴ may be subdivided into compartments, supplied from above by a perforated distributing pipe E, provided with a funnel or receiving cup E¹. For delivery purposes, each compartment has a pipe E²; and all the pipes converge to the receiving chamber or barrel F of a screw-down plug-valve. From this valve the liquid flows in regulated quantities on to the perforated distributing dish G, from which it passes to the chamber A². H H¹ are sets of screens or frameworks covered with absorbent material, forming domes (vaporizers). These sets of vaporizers (which may consist of two, three, or more screens) are placed in the chambers A² and A³ respectively, and over the respective inlet-pipes B¹, B², of each chamber. The hydrocarbon liquid flows from the dish G in fine streams, drops into the outer of the set of three vaporizers H, down which (when completely saturated) it runs, and collects at the bottom, and then, by capillary attraction, saturates the other two vaporizers. The set of two vaporizers H¹ in the water chamber A³ is saturated from below by capillary attraction.

When making gas according to this invention, it is necessary to proceed as follows: Atmospheric air is caused to enter (by pressure or exhaust) by the pipe B into the chamber A¹, from which it passes, by the pipe B¹, to the chamber A², beneath the vaporizers H. It is then caused to pass through the absorbent porous material, taking up a proportion of hydrocarbon vapour, and enters the pipe C, by which it is conveyed under the water vaporizers H¹ in the chamber A³ to be further treated. The carburetted air is then caused to pass through the water vaporizers H¹, taking up a proportion of water vapour, by which it is converted into a gas which is portable and of high heating power. From the chamber A³, the gas passes through the valve I, into the collecting chamber A⁵, and thence, by way of the pipe D, to the holder, or otherwise, for use. Where the hydrocarbon used proves too rich in carbon for the purpose for which the gas is intended, and the gas requires to be diluted to a greater extent than would

ordinarily take place if the whole of the air were passed through the entire apparatus, a portion of the air is passed direct by the pipe $B^2$ to the chamber A3, below the vaporizers $H^1$, where it mixes with the rich carburetted air, and dilutes it before passing through the water vaporizers to be converted into permanent gas.

As to using the gas, the inventor remarks: "The gas produced is ordinarily a non-luminous gas, and when employed for lighting purposes, is used to produce what is known as incandescence lighting; but the gas, additionally carburetted, may be converted into a luminous gas."

**Waste Preventing Gas-Heated Hot-Plates.**—Brophy, M. M., of High Holborn, W.C. No. 6662; April 30, 1890. [6d.]

This invention relates to gas-heated hot-plates of the kind described in patent No. 14,634 of 1888, in which means are provided for preventing waste of gas; but which apparatus, it has been found, when in use, becomes choked with grease and dirt so as to be inefficient if not properly cleaned.

To obviate this defect, there is arranged a rod, provided with a conical head, to pass through the air and gas mixing chamber of the Bunsen burner; the gas being admitted at the lower end of the chamber by a spring valve attached to the rod, and issuing through and burning at a series of openings at the top of the chamber. A tube extends from the opening covered by the gas-valve to a point inside the chamber above the top of the air openings, so as to prevent dirt or grease passing into the valve. The conical head of the rod has a downwardly projecting lip or flange, to prevent any dirt or grease getting into the stuffing-box. The top of the burner is made somewhat larger than the body, so as to act as a support for the burner, which is passed into a hole in the hot-plate.

**Gas-Engines.**—Donnington, A. A., of Longsight, and Coates, H., of Greenheys, Manchester. No. 6910; May 5, 1890. [4d.]

This invention refers to the position and angles of gas-engine cylinders; the improvement consisting in having two cylinders, one placed above the other—the top one being in a horizontal position and the lower one at an angle. Alternatively, the lower cylinder may be placed horizontal, and the top one at an angle; or both cylinders may be placed at an angle. The connecting-rods of each engine are coupled to the same cranked shaft. By such an arrangement of cylinders, the floor space is reduced, and the working parts of the engine are rendered steady. This arrangement may be adapted in using several cylinders in the positions and angles as described; the valves for admitting the charge being placed at the back end of the cylinders, or else at the sides.

**Gas and Compressed Air Motors Combined.**—Mewburn, J. C.; communicated from R. Proell, of Dresden, O. L. Kummer, and E. Fischinger, of Niedersedliz, Germany. No. 7177; May 8, 1890. [8d.]

The patentees point out that in motors the driving power of which is compressed air, it is necessary to heat the air before it enters the motor or during expansion, because otherwise the air cannot work expansively, and therefore not economically, as the temperature of the expanding air would be reduced to such an extent as to interfere with the proper working of the engine. In other words, heat must be conveyed into compressed air-engines. In gas or other explosive engines, the process is exactly reversed, as a great excess of heat is liberated by the explosions, which must be conducted away by water-jackets or other means. The present invention therefore consists in combining a compressed air motor and a gas or explosive motor in such a manner that an exchange of heat takes place between the two motors—viz., the excess of heat generated by the explosive motor serves to heat the compressed air, while the excess cold created by the compressed air motor serves to cool the explosive motor.

**Incandescent Lighting by Calefacient Gases.**—Cruikshank, G. M.; a communication from J. C. Reissig, of La Plata, P. F. Maccullum, of Helensburgh, N.B., and J. Laudin, of Stockholm, Sweden. No. 7335; May 12, 1890. [8d.]

This invention relates to the application of the calorific power of calefacient gases (burnt by means of burners giving flat flames) to refractory substances manufactured into bars, rods, or needles, and arranged in such a way that they may be effectively heated by the flames issuing from the burners. The invention is primarily applicable to the Fahnehjelm system of incandescent lighting; but it may also be applied to other systems in which the illumination is due to the incandescence of refractory substances (metallic or otherwise).

In the Fahnehjelm system, as may be remembered, a number of small rods of a specially refractory composition, arranged generally in two straight and parallel rows, are fixed by suitable cement in a metallic socket; the aggregation of small rods together with the socket being termed a "comb." These combs are suspended at a suitable height above ordinary flat-flame burners (such as Bray's No. 3 union-jet or slit burners), and rendered incandescent by the combustion of water gas. The combs have heretofore been used vertically, or nearly so, in which position they give their best illuminating effect in directions at right angles to their planes, but not equally in other directions, in proportion to the absolute photometric power of the lights.

The first part of the invention consists (with a view to obtain a better downward and more equal illumination) in inclining the combs X and burners Y to any required angle, as seen by figs. 1 and 2; and furthermore in ensuring sufficient contact of the calefacient flame with the comb by placing a plane A of any sufficiently refractory material (metallic or otherwise), preferably with a reflecting surface, immediately above or behind the combs in such a way as to guide the flame in the direction of the axes of the refractory rods or needles forming the comb, and to neutralize as far as possible any tendency of the flame to leave the comb through the action of upward currents of air. The planes A placed above the burners and behind the combs are called "guide-reflecting surfaces," because they serve the twofold purpose of guiding or directing the flames and reflecting the light produced by the action of the flames on the rods or needles forming the combs. These surfaces should not be placed so near the comb as to come into actual contact with the flames; and it is recommended that they should not be at a greater distance from the comb than about an inch. In practice, excellent results are said to have been obtained with a space of three-eighths of an inch between the combs X and the reflecting surfaces.

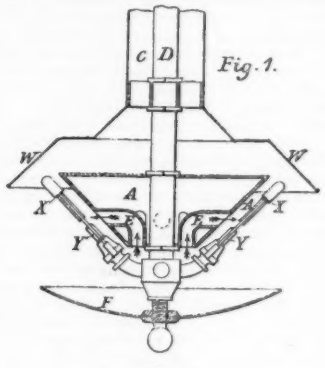


Fig. 1.

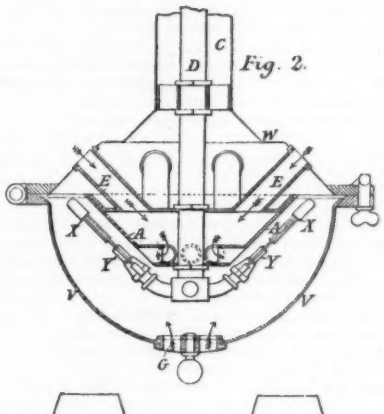


Fig. 2.

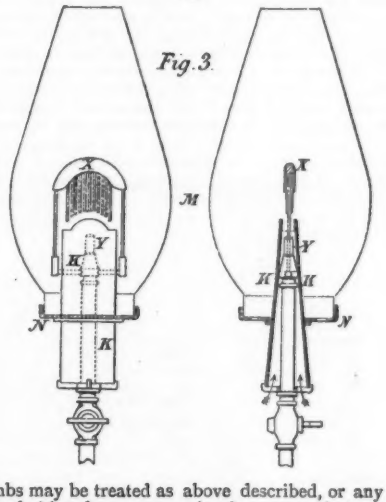


Fig. 3.

Single combs may be treated as above described, or any number of combs, inclined either from or to each other to any desired angle, may be grouped together in proximity with reflecting surfaces arranged so as to project the light in any direction. When a number of flames with the burners inclined outwards are thus arranged in a circle, so as to give an equal illumination in all directions, the surfaces A form an inclined polygonal vessel of some depth, with a flat surface opposite each flame; or when the number of flames is considerable, the inclined reflecting vessel may be made circular. These reflecting vessels may be of any diameter to suit the number of flames required; but when lamps of very great power are required, it is preferable to keep the diameter within certain limits, and to arrange the reflecting vessels and flames in tiers or rows one above the other.

In the Fahnehjelm system as practically applied, the combs are supported in the proper position above the burners by small metallic wire supports resting in sockets attached to the gas-brackets; but in lamps of the construction just described, the wire supports may be dispensed with, and the combs attached directly to the guide-reflecting surfaces by brackets. When an absolutely downward illumination is required, the combs and burners with the guide-reflecting surfaces above them may be fixed almost horizontally. The invention further consists, with a view to obtain improved illuminating effect and economy in consumption of gas, in applying the principle of regeneration or recuperation to lamps of the types already described. This is accomplished by such an arrangement as is shown in fig. 1. This is a suspension four-flame lamp, which is partially regenerative. The gas-inlet pipe D passes downwards through the chimney C, and through the reflecting vessel A, the upper and lower parts of which are closed in such a way as to convert the interior into a practically air-tight chamber somewhat resembling an inverted pyramid. The gas is thus considerably heated before it reaches the burners Y. Some of the air for supporting combustion may also be heated by conducting it through tubes E, which

pass through the interior of the reflecting vessel A. A hood W, somewhat larger than the upper part of the reflecting vessel, is placed above the lamp; the chimney C being connected to the hood to conduct away the hot products of combustion. As the interior of the vessel becomes highly heated after the lamp has been in operation for a short time, a considerable degree of heat is imparted to the air passing through the tubes E with a correspondingly beneficial effect on the illumination. A glass tray F is provided below the burners Y to arrest any falling particles of magnesia.

Fig. 2 illustrates a fully regenerative lamp constructed with a view to obtain the highest illuminating effect with the greatest economy in the consumption of gas; the flames being enclosed in a glass globe or lantern V, and all the hot waste gases caused to pass into the chimney C. The whole of the air to support combustion may be introduced above the globe or lantern through tubes E, and led into the interior of the highly-heated reflecting vessel A; and an auxiliary supply may also be introduced through a valve G in the bottom of the lantern.

Fig. 3 illustrates, in side elevation and in transverse vertical section, a simple method of increasing the illuminating power of the Fahnehjelm comb X. Here a metallic shield K encloses the burner and a part of the calefacient flame. When a funnel M is employed, a rest plate or gallery N of glass or metal is attached to the shield to support it in proper position. The shield K is so arranged as not to interfere appreciably with the downward illumination; and its upper sides approach closely to the points of the incandescent needles—thus enclosing the flame and protecting it from transverse air currents without interfering with its proper combustion. The shield becomes highly heated, and in turn imparts heat to the air ascending through it to the burner, with a correspondingly beneficial effect on the illumination. The rests or galleries may be perforated to ensure the supply of sufficient air to promote complete combustion of the gas.

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**Gas-Fires.**—Mackinlay, R. W., and Darwin, H., of Glasgow. No. 9531; June 19, 1890. [8d.]

This invention has for its object the general utility of gas-fires: (1) By making the visible surface of the heat arresting and refracting body of loose and detachable sections. (2) By making the sections interchangeable. (3) By making each of the sections capable of arresting, detaining, and refracting a larger amount of heat from the lighted jets of gas than is usually obtained.

The heat arresting and refracting body of the fire is constructed of perforated frets of metal or baked clay (or of both materials combined), suspended in horizontal serrated rows across the face of a canopied fire-brick, after the manner of louvre plates or Venetian shades. Each fret is separate from its neighbour; complete in itself; and removeable and replaceable at pleasure. It reposes on side racks or ledges, and is heated from beneath. Each fret has contact with the one immediately above or beneath it so as to give the appearance of one glowing mass of fire. Should the lower frets (which receive the fiercest heat from the flames) show signs of undue oxidation, they may be changed with some of the higher ones; thus maintaining an even degree of wear and tear throughout the sections by transposition of the parts.

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**Ignition Devices for Gas Motor Engines.**—Kaselowsky, E., of Berlin. No. 19,171; Nov. 25, 1890. [6d.]

The object of this invention is an improvement on the disposition of an auxiliary inlet for the explosive mixture with a separate ignition device situated behind it, in addition to the inlet proper for the gas and air mixture, which disposition is embodied in patent No. 4574 of 1890.

This arrangement is capable of being so modified, without changing the manner of action, as to cause also the main charge to be supplied through the igniting sleeve, if the latter is made to enclose at the same time suitable regulating devices for a corresponding supply of power and ignition charge; the rest of the arrangement remaining unaltered. Through such regulating devices, says the patentee, the gas and air valve, or one of these two valves, is so regulated that, "at the commencement of the initiatory period, a less explosible gas mixture of but little gaseity is sucked in; and at the termination of the initiatory period, a rich explosible gas mixture enters into the ignition sleeve, filling the same." The "closeable" ignition-pipe, with condensation chamber, constructed in accordance with the earlier patent referred to, being disposed direct at the ignition sleeve, the consequence of this two-fold feeding of the ignition sleeve with gas mixture is (as in the main patent) an economical working and feeding of the motor as well as a certain ignition of the charge.

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**Fluid Meters.**—Nash, L. H., of South Norwalk, Connecticut, U.S.A. No. 19,443; Nov. 29, 1890. [11.]

This invention relates to water-meters in which a case contains an interior fixed abutment having alternate projections and recesses or corrugations, and a piston provided with alternate projections and recesses or corrugations, which co-act with the corrugation on the abutment in order to form a plurality of enlarging and contracting measuring-spaces. A special feature of the arrangement is a provision by which the meter is prevented from being damaged by freezing. For this purpose the upper head of the case is formed so that it shall be very much weaker in thickness at some point than the body of the case; it being, however, made amply strong to sustain the ordinary pressure of the water to which it will be subjected in actual use, but not strong enough to sustain the pressure due to the freezing in the case. The body of the case is, however, made very strong, so that when the water freezes in the meter, the case will not be injured, but the upper head will yield with the pressure of the ice; and thus prevent all excessive strain upon the case. In order to accomplish this without danger of the case-head changing its form under the water-pressure and from other causes, the head is preferably made of sufficient thickness, and then a groove is formed round the portion of the head which it is desired shall yield to the freezing-pressure. In this way the case-head keeps its shape under all ordinary conditions of pressure, but will yield readily to excessive pressure before the case is in danger of being destroyed. The same effect can be accomplished by making the upper head of uniform thinness; but for the reasons given, it is preferably formed of unequal thickness.

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APPLICATIONS FOR LETTERS PATENT.

5701.—Ketchum, O. W., "Improvements in gas-generating furnaces or gas-producers." April 2.

5738.—Newton, C. B., "Differential pump gearing." April 3.

5747.—Skene, R., "Controlling fluid pressure, preventing fluctuation, and regulating the quantity of gas or vapour to gas-engines." April 3.

5774.—Ritchie, J., "Improvements in mechanism for automatically lighting the gas-jets of illuminated clocks." April 3.

5777.—Bruce, W. T., "Improvements in the manufacture of sulphuric acid and apparatus therefor." April 3.

5787.—Edwards, C. H., "Improvements in the manufacture of gas-retorts, and other like earthenware or clayware." April 3.

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## CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

### The Affairs of the Commercial Gas Company.

Sir,—Permit me to take exception to the concluding paragraph of your editorial of April 7, under the above heading.

In no sense, in the matter of the *Eastern Star*, *s.s.*, was the Company "at the mercy of any Union." In my remarks, at this Company's general meeting, I thought I made it clear that we had no direct relations at all with the men who declined to discharge the ship. It was in no way the Company's business, but we suffered some delay in consequence of their wrongful action; and the matter was referred to by our Chairman and myself solely for the purpose of showing how unwarrantable was the course taken, as indirectly affecting the Company's receipt of raw material.

It might have been very heroic to have gone by the parties who were legitimately concerned with the dispute of the *Eastern Star*, and have challenged an all-round strike by interfering with what was no legitimate concern of ours. But such a course would have been plainly quixotical; and would have savoured more of "Donnybrook Fair," than of minding our own business.

*Commercial Gas Company, Stepney, E., April* 9, 1891. Hy. E. Jones.

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### Superannuation Funds in Gas-Works.

Sir,—I am desirous of forming a superannuation fund amongst the workmen under my charge. No doubt, amongst your many readers, there are managers of works where such funds are in existence. If so, I should be greatly obliged if they would favour me with copies of their rules regulating the administration.

*April* 11, 1891. J. W.

[We shall be pleased to forward to our correspondent any copies of rules sent to us in response to the above letter.—Ed. J. G. L.]

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**New Joint-Stock Companies.**—A Company, having the title of the Water Concessions Syndicate, Limited, has been formed, with a capital of £1025, in 100 founders' shares of 5s. each and 1000 ordinary shares of £1 each, to carry on generally the business of a loan company. The business of Messrs. J. Dawson and Co., chemical manufacturers, of Kirkheaton, near Huddersfield, has been taken over by a limited liability company, with a capital of £30,000, in £10 shares. The Weybridge Electric Supply Company, Limited, has been formed with a capital of £15,000, in £5 shares, to carry into effect an agreement entered into between the Laing, Wharton, and Down Syndicate, Limited, and Percy Mossop, of Weybridge, on behalf of the Company, for the acquisition of the electric lighting depôt at Weybridge, and the development and extension thereof.

**Sunderland and South Shields Water Bill.**—Last Tuesday a large and influential meeting of manufacturers consuming water supplied by the Sunderland and South Shields Water Company was held at Newcastle, to consider the question of opposing the Company's Bill in the House of Lords. It was alleged that the manufacturers were at present at the mercy of the Company, who could withdraw the supply or raise their charge at any time at their own discretion, as it was considered had been done in the past. The manufacturers desired a fixed maximum scale for water used for trade purposes, not subject to the caprice of the Water Company, but subject to the requirements of domestic supply. A strong opinion was expressed that if the large consumers of water were not met in an amicable spirit by the Company, they would be driven to form an association for obtaining an independent supply. It was agreed to oppose the Bill, if proper arrangements could not be effected.

**The Water Supply of Conway and Colwyn Bay.**—On the 31st ult., Mr. J. Smith, C.E., held an inquiry on behalf of the Local Government Board, touching an application for the issue of a Provisional Order constituting the Conway Urban Sanitary Authority and the Colwyn Bay and Colwyn districts with Conway Rural Sanitary Authority into a united district for the supply of water. The scheme is one propounded by Mr. Farrington, C.E., the Borough Surveyor of Conway; the sources of supply being Cowlyd Lake, above Llanrwst, and two miles distant from Dulyn Lake, whence Llandudno derives its supply. Mr. Farrington gave a detailed report of the scheme; and he estimated the cost of the works at £16,200. Mr. T. T. Marks, C.E., handed in figures as to the gauging of the stream, and said he had no hesitation in speaking of the scheme as one of the grandest in North Wales. Evidence was also given by other witnesses; and the Inspector said he should visit the lake and report in due course.

# PARLIAMENTARY INTELLIGENCE.

## HOUSE OF COMMONS.

### Monday, April 6.

THE LIGHTING ARRANGEMENTS OF THE HOUSES.

In the course of the discussion on the estimates to-day, the question of the lighting arrangements of the Houses was brought forward on the motion to complete the sum of £34,625 for the Houses of Parliament.

Mr. LABOUCHERE called attention to the item of £1900 for oil-lamps used in the Houses. He said there had recently been considerable expenditure for electric lighting, and there was also a large amount spent in gas. He did not know where the oil-lamps were used. It was absolutely impossible that such an amount of oil could be burnt in the House with the gas and electric light they had. He suspected some contractor derived a huge profit out of the transaction; and for this reason he would move the reduction of the vote by £1000. In connection with this subject, he thought the First Commissioner of Works would confer a public benefit if he would cause a record to be kept of the cost of each electric lamp in the House per hour, because many persons had found that the present forms of electric meters were entirely incorrect.

Mr. PLUNKET said the parts of the building in which the greatest amount of the expense for oil-lamps was incurred were not those with which honourable members were most conversant; being the committee-rooms and the official residences. The electric light was not installed in the places where the greatest number of oil-lamps were used. A larger estimate had been made this year than would otherwise have been the case from the fact that they had found by experience of autumn sessions that the consumption of gas, oil, and electric light was much greater than in an ordinary year. Electric lighting, at all events in the present state of the science, was more expensive than the old system of gas and oil. It now cost about £1300 a year. They hoped to effect a saving of £600 in gas and of 145 oil-lamps as against the increase in the cost of electric lighting. He would make inquiries as to what means they had of gauging and checking the cost of the electric lamps.

Mr. LABOUCHERE complained that the right honourable gentleman had not answered the *gravamen* of his charge, which was that there was a middleman who received a sum of money each time a lamp was lit, whether it burnt for a long or short time.

Sir G. CAMPBELL hoped the right honourable gentleman would look into the question of contracts, as there was certainly great room for economy. He would also call attention to the fact that the electric lighting in the reading-room was not good.

Mr. H. WILSON pointed out that the charges for lighting were the same now as they were when the House used to sit till a much later hour.

Mr. PLUNKET said that during the recess changes had been made in the electric lighting of the reading-room, by which it was hoped that an improvement would be effected; and more would be done in the next recess. With regard to the contract in connection with the oil-lamps, it was not a question of the middleman at all; it was a matter of economy. There was great irregularity in the number of lamps employed; and therefore it was found better to pay a certain sum when a lamp was used. Some of the lamps were burning occasionally for from 12 to 14 hours each night. He did not think the cost of the lighting arrangements of the House could be materially reduced. He was willing to furnish a return of the prices paid to the contractors, and would inquire into the whole matter.

### Thursday, April 9.

ELECTRIC LIGHTING IN LONDON.

Mr. S. BALFOUR asked the President of the Board of Trade whether the Board intended to grant a third Provisional Order, under the Electric Lighting Acts, in any district in London where there are already two electric lighting companies empowered by Provisional Orders to supply electricity; and whether, if so, he would explain why it was intended to depart from the principle laid down by the Board, after the inquiry in 1889, that there should only be two companies, each for a different system, authorized by Provisional Orders in one district, and also from the policy of the Board as stated by the President on May 12 last year.

Sir. M. HICKS-BEACH: It is not intended to grant a third Provisional Order under the Electric Lighting Acts in any urban district where there are already two electric lighting companies empowered by Provisional Orders to supply electricity, unless there are strong reasons to suppose that one of such companies will be unable to exercise their powers within a reasonable time. Where, however, this is the case, I do not think it is desirable that the inhabitants of a district should be entirely debarred from all advantage of competition.

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The following progress was made with Private Bills last week:—

Bill read the first time: Local Government (Ireland) Provisional Order Bill [Kilrush Gas-Works Purchase].

Bills read a second time and committed: Bristol Gas Bill; Mountain Ash Local Board Bill.

Bills read the third time and passed: Bognor Water Bill; Fylde Water Bill; Garw and Ogmore Gas Bill; Western Valleys (Mon.) Water Bill.

Petitions against the following Bills were presented:—

Bristol Gas Bill, from the Corporation of Bristol.

London Water Commission Bill, from the Bromley Rural Sanitary Authority, Dartford Local Board, Dartford Union, Hoddesdon Water Company, Kent County Council, Leyton Local Board, Reading Corporation, St. Pancras Vestry, Walthamstow Local Board, and Willesden Local Board.

Malvern Water Bill, from Lady Emily Foley (against alterations) and C. M. Berington.

Metropolis Water Supply Bill, from Bromley, Broxbourne, Colne Valley, Dartford, Edmonton, Grand Junction Canal Company, Heston, Hoddesdon, Kingston, Leyton, London, London County Council, Teddington, Tottenham, and Walthamstow.

# MISCELLANEOUS NEWS.

## GAS LIGHTING AND GAS APPLIANCES AT THE GLASGOW EAST-END INDUSTRIAL AND FINE ART EXHIBITION.

This exhibition, the object of which is to provide, or assist in providing, means for establishing "an institute for the intellectual and social improvement and recreation of the inhabitants of the East-End of Glasgow," has been quite a feature of the social life of that great commercial and industrial community in the past winter and early spring months, and it is now rapidly drawing to a close. It was opened shortly before Christmas by the Marquis of Lothian, the Secretary for Scotland; and it will be closed on the 21st inst. by Lord and Lady Aberdeen, who are both very popular in Scotland, and are representative of the "other side" of politics north of the Tweed. Unlike most other large exhibitions, this one has not had any open-air attractions, owing to the period of the year during which it has been held; but, notwithstanding this fact, it has been attended with a most remarkable amount of success, and has thus shown a striking contrast to the Electrical and Engineering, &c., Exhibition, which proved to be such a *fiasco* in Edinburgh last year. Up to the time of writing, the number of persons admitted by season tickets or by payment at the gates has reached well-nigh 650,000; and it is estimated that at least £4000 will be available for the purpose named in the opening sentence of this article.

Many circumstances have contributed to bring about the success referred to; but it is not necessary that these should be enlarged upon or even mentioned in detail. Unlike almost every other exhibition of the kind held during the past dozen years or so, either at home or abroad, the internal illumination of the halls, galleries, and courts has been done not by the so-called "light of the future," but by the light of the present, and of the past three-quarters of a century, so far as Glasgow is concerned. Here and there the electric light has been "installed," but only in an incidental way by exhibitors—never officially by the exhibition management, by whom gas lighting has been carried out in the same places, as if no electric light installations were there—the argument doubtless being that the gas lighting could be depended upon as *certain*, alike at the opening and all through the period of the exhibition; whereas the "other light" would always be a "doubtful quantity," and uncertain as to its action.

Gas having been resolved upon as *the* illuminating agent of the exhibition, it was but natural to suppose that lamps constructed on the regenerative principle would be extensively brought into use; and this has been the case. The exhibition buildings are at a considerable distance from the main thoroughfare (Duke Street) on which, in a sense, they abut; and consequently, on taking the exhibition "season" into consideration, it was deemed absolutely necessary to erect a temporary covered way, which after a time bifurcates—one portion leading direct to the old buildings (formerly the Boys' Reformatory or House of Refuge), and the other to the new buildings, one special feature of which is an immense concert-hall. The lighting of the covered way was handed over to Messrs. W. Ramsay and Co., the local agents for the Siemens regenerative lamps, and well known as lamp manufacturers and gas-fitters. The lamps in use are all of the most recent type of the Siemens system with inverted burner, and are perfect of their kind. The flame is intensely bright, steady, and of a pure white; indeed, visitors frequently mistake these for electric lamps. There are three sizes in use—Nos. 3, 4, and 7, which give respectively an illumination of about 107, 178, and 360 candle power; the cost of gas per hour being in the respective cases about ¼d., ½d., and ¾d. Lamps of this kind, about 110 in number, are distributed not only throughout the covered way, but likewise in a large portion of the main exhibition building, in the section devoted to the machinery in motion, over exhibitors' stands, in a portion of the refreshment-rooms, exhibitors' club, smoking retreat, &c. In addition, there is a magnificent Siemens lamp over the main entrance to the covered way. This is said to have an illuminating power of 680 candles; while its consumption of gas is represented by about 1¼d. per hour. After the close of the exhibition, it will be removed to Paisley, for the permanent lighting of some business premises. A considerable amount of the gas-piping was also run by Messrs. Ramsay and Co., who, it may be remembered, did the gas-fitting for the Glasgow Exhibition of 1888, and that for the new Municipal Buildings of the Glasgow Corporation.

The great bulk of the official gas-fitting contract was excuted by Messrs. Alexander Brown and Co., gas engineers, of Glasgow. It included the running of upwards of five miles of iron tubing, ranging from 4 inches down to ⅜ inch in diameter. Two 6-inch mains were led in from Duke Street, and the 4-inch tubes were joined to them. Messrs. Brown and Co. also executed a large quantity of the lighting proper with their patent "Lucient" and "Eclipse" regenerative lamps, of which they are likewise the manufacturers. There are upwards of 90 of these lamps throughout the exhibition. The illuminating power given out by Messrs. Brown's regenerative lamps collectively is equal to upwards of 18,000 standard candles; and this is obtained by a consumption of something like 800 cubic feet of gas per hour. In one portion of the Fine Art Gallery, it was found necessary to use obscured shades upon the lamps, in order to show the pictures to advantage; the light being so strong as to cast somewhat pronounced shadows.

In several sections of the exhibition which are housed in the old buildings, the Welsbach incandescent gas lights are used. These lamps are of the newest type, and the rooms in which they are installed are certainly notable for the coolness and comparative purity of the atmosphere; but the lighting is not altogether "up to the mark." This may be, however, owing to the lamps being used in insufficient numbers. In some of the lamps the lower half of the "mantle" is intensely white, while the upper half shades off into yellow and pale brown. It is just possible that the internal appearance of the rooms where these lights are installed would be materially improved by employing some kind of shade, so as to hide the rather offensive "mantle" when it assumes the character just mentioned. The light in question is a beautiful and interesting application of several nice points in physics;

but there is certainly much room for improvement, before perfection can be claimed for it.

In the Grand Hall and in the two courts by which it is flanked east and west, what is known as the Stott-Thorp "Reflex" light has been adopted on a large scale—in the Grand Hall exclusively, and always in the pendant form. This is one of the newest gas lighting inventions brought into notice in the Glasgow East-End Exhibition. It is at the same time the simplest and least troublesome to work with; and it seems to be as efficient as it is simple. The "Reflex" lights, which are supplied by Messrs. J. Stott and Co., of Oldham, form a conspicuous and pleasing feature of the hall. The lamps are of the open-flame type—not regenerative, in the ordinary sense of the term; and they owe their great illuminating efficiency principally to a powerful reflector, which is so devised as to flatten out the flame yielded by an ordinary gas-burner. The full radiating power of the flame is in this way obtained. The hall is arranged to seat about 3000 persons, without gallery; and the entire cost for gas is said to be less than 2s. per hour—certainly a gratifying result when compared with the cost of giving the same amount of illumination by the electric light. There are in use close upon 50 "Reflex" lights, one of which is a great sun-light pendant over the front of the organ and orchestra gallery. It consists of 56 jets, all of which are beautifully shaped. They do not appear to give off any smoke; and the flames are perhaps partly produced on the regenerative principle, for both gas and air become very highly heated before combustion actually takes place. All the other Stott-Thorp lamps in use at the exhibition are of a much smaller size; indeed, they range down to 16, and even to 6 burners. Since these lights were installed in the exhibition, they have excited a great amount of attention amongst the leading architects of the city and other parts of Scotland; and it seems likely, from the nature of the inquiries made, that the lamps will soon be largely adopted for schools, churches, halls, &c. Messrs. Stott and Co. have also their usual show of gas-governors, &c.

In respect of gas-fires, stoves for cooking, and other gas-heating appliances, the exhibition not only makes a fair show, but in one instance a remarkable one. The instance referred to is that of the display of gas-fires made by the new Glasgow firm of Messrs. H. Darwin and Co., Limited. The managing partner of this concern has during the past twelve years held a prominent position in connection with the invention and manufacture of appliances for increasing the demand for gas, and more especially for adding to its day consumption. He was associated for most of that time with well-known firms engaged in this particular class of business; and consequently the extent of his experience in designing and working out the construction of heating and cooking stoves, &c., has been almost unique. His firm went into the Glasgow exhibition with a degree of enterprise that was perfectly remarkable. They opened a stand, chiefly for the display of gas-fires, which at once became quite a feature of the exhibition, so elegantly was it equipped, and so handsome and efficient were the fires installed. These are of two kinds—first, those which are called "caloric" stoves, which provide an abundant supply of pure heated air to the apartment in which the fire is used, the air also being rendered decidedly moist in its passage through the stove; and, secondly, the "Darwin" patent fire. Of the former there are three sizes already made; and of the latter, as many as seven different kinds. It is scarcely necessary to enlarge on these gas-fires, as their appearance and general character will be familiar from the advertisement pages of the JOURNAL. The "Darwin" cooking-stove was not ready at the opening of the exhibition. It has, however, since been perfected and manufactured in large numbers; and it certainly possesses some excellent and commendable features. Its heating power internally is regular throughout; and it embodies an arrangement whereby a powerful top heat may be generated and concentrated, so as to do baking in a most thorough manner. Then again, there is its boiling power, which is very great; and there is a patent griller, in which a cook possessing ordinary skill can get through a large amount of work. Messrs. Darwin and Co. did not stop short in their enterprise with their show stand, but rented a large room within the old buildings on which they effected a wonderful transformation in order to convert it into a cookery school. Early in the year they commenced to give free cookery lessons and demonstrations in this room—one every afternoon, and another in the evening; some of the best-known lady lecturers in the kingdom being engaged to demonstrate the utility of gas as the heating agent for doing the cooking. Ladies came from far and near to hear these valuable lectures, attending in such numbers that it was stated a few days ago that upwards of 30,000 persons had been present at them. Such an extensive system of cookery lectures was quite unique; and their instruction has been of such great value in adding to the success of the exhibition, that Messrs. Darwin and Co. have received the hearty thanks of the active promoters of the exhibition. Of course, the "Darwin" gas-cooker alone has been used at the demonstrations; and some notion of its efficiency may be formed when it is stated that two of the lecturers turned out dinners of seven courses for about a dozen persons with the consumption of from 40 to 42 feet of gas, which, at 2s. 6d. per 1000 feet, would cost but a trifle.

Messrs. C. Wilson and Son, of Leeds, also show in the same department of the exhibition a great variety of gas fires, cookers, and other gas-heating appliances. Messrs. J. Johnston and Co., Glasgow, likewise do something in the same line, but only on a small scale.

In the department of gas motors, there is a varied and excellent display; and, of course, it would be incomplete if it did not include an assortment of Messrs. Crossley's "Otto" engines. There are at Messrs. Crossley's stand four of these engines, all as perfect in their workmanship as it is possible for them to be. One is a 14-horse power high-speed engine specially designed for driving electric lighting plant. It is combined with a "Joel" dynamo, from which current is obtained for a small installation of incandescent lamps, which work with great steadiness without the use of accumulators or a fly-wheel on the dynamo. This particular engine has been greatly admired for its simplicity in action, and for the ease with which it is started. There is a 5-man power engine combined with pumps, designed for pumping at public works or for the domestic water supply at mansions, &c. It seems that there is now a great demand for small engines for these purposes. Messrs. Crossley's collection also includes a neat and handy domestic or 2-man p ower engine.

Messrs. A. Burt and Co., of the Mountblue Engineering Works, Glasgow, had originally four examples of the "Acme" gas-engine (M'Ghee and Burt's patents) distributed throughout the exhibition. The smallest of them—an engine of 1-horse power—has been removed by the purchaser. Another, of 2-horse power, is driving the printing machinery and a loom shown by the Scottish Wholesale Co-operative Society; and amongst the others there is a 9-horse engine which is driving the main shafting of the machinery-in-motion department, a dynamo for working the search-light, and an electric motor for driving the models in the Artizans' Section of the exhibition. There is also a 4-horse engine which supplies the blowing power for the grand organ. All except the one last referred to have been sold. These "Acme" engines have been favourably reported upon as to their economy by Professor W. T. Rowden, of the Glasgow and West of Scotland Technical College, who is a reliable authority on the testing of light, heat, and power, and is himself engaged in bringing out a gas-engine on somewhat new lines.

Some excellent features are seen in three engines of the "Stockport" type which are shown by Messrs. J. E. H. Andrew and Co. They are all used in driving electric lighting and electric motor plant. The steadiness of their running is very marked.

The "Fielding" gas-engine, made by Messrs. Fielding and Platt, of Gloucester, is the only other motor of the kind to be mentioned. It is shown in but one size. There are some good parts about it.

In closing these notes on the Glasgow exhibition, it may be mentioned that already the quantity of gas consumed has been so great that something like £800 will be required to pay for it. This fact alone shows that the exhibition has been quite unique of its kind.

## THE STOCKTON CORPORATION AND THEIR GAS STOKERS

Considerable discussion took place, at the Meeting of the Stockton Town Council last Tuesday, on a subject which has excited some stir in the town; it being alleged that Mr. W. Ford, the Manager of the Corporation gas-works had discharged several of his men because they had joined the Gas Workers' Union. Alderman Richardson, in moving the adoption of the Gas Committee's minutes, denied that this was so. He said no one appreciated the members of Unions more than he did; but the men who joined such societies had duties to learn and duties to perform as well as other men. The men in the Committee's employ who had joined the Gas Workers' Union were very few indeed—only six or seven. One of their leaders from London who interviewed Mr. Ford told him that he thought the men had great privileges and advantages; and if the men at the South Metropolitan Gas-Works had had similar advantages, there would have been no strike. It appeared that in the present trouble only three of the men were concerned. Two men in particular seemed to have the opinion that they were going to keep the Manager under. One absented himself without leave for seven days; and the foreman had to find another man to fill his place. The other man, who had been employed as a pipe-layer, was discharged, not because he was a member of the Union, but because he absented himself. He (Alderman Richardson) appealed to the Council to say whether it was not necessary that the men should be under the control of the foreman in charge. Complaint had been made as to the foremen. One foreman had been under the Committee and Mr. Ford for 27 years, and another for 25 years, which was not a bad record. The other man, it seemed, took away his tools, and said he would not work at stoking again, and left the place. Next day Mr. Ford found him at another job, and asked him whether he had been ordered to do that work. The man replied "No," he had started himself. Mr. Ford was naturally angry, and could not allow him to go and do work without his sanction. Alderman Richardson proceeded to read a statement of Mr. Ford's, in which he said that in September, 1889, the men asked for an advance of 2s. He inquired if they had any grievance, and they said they had not; but they would be perfectly satisfied with the advance. In November the labour troubles commenced. The majority of the men, however, decided that they would not join the Union but would remain loyal to the Gas Committee. At the present time there were a number of trades' unionists employed at the gas-works. The men were not discharged because they were unionists, but because they were doing their work in an unsatisfactory manner. In conclusion, he said that he did not know of any town, save Sunderland, that had cheaper gas than Stockton; and he paid a high tribute to Mr. Ford's admirable managerial skill. The Mayor (Mr. R. H. Appleton) having seconded the adoption of the minutes, Mr. Samuels said he had heard both the men's and Mr. Ford's versions; and he was convinced that the men were discharged because they belonged to the Union. Mr. Ford remarked that no pressure was brought to bear on the men not to become members of the Union; and the majority of them expressed their sense of the kind way in which they had been treated, and voluntarily offered not to join. If the non-Union men had behaved in the same manner as those connected with the Union, the gas-works would have been stopped, and Stockton thrown into total darkness. Mr. Samuels intimated that the Trades Council were not going to let the matter rest, because the great principle was involved whether a man should be discharged because he belonged to a Trades Union. The Council appeared to be generally in sympathy with Mr. Ford, and disposed to accept his and Alderman Richardson's assurance that the men had not been discharged on account of their joining the Union. Consequently no action was taken in the matter.

**San Paulo Gas Company, Limited.**—The report of the Directors of this Company for the twelve months ending Dec. 31 last states that although the revenue was to a certain extent prejudiced by the high rate of freights which ruled during the year, and which has been met by the freight equalization account, a dividend of 10 per cent. per annum, tax free, is recommended, carrying forward £1238. As further extensions of the works will shortly be necessary to meet the increased demand for gas, it is proposed to issue the remaining £50,000 of capital, powers for which were obtained in May last.

## MANCHESTER CORPORATION GAS SUPPLY.

### The Price and Quality of the Gas—The Cost of Electric Lighting.

At the Meeting of the Manchester City Council last Wednesday—the Mayor (Mr. Alderman Monk) presiding—a question was asked by Alderman Russell as to whether there was as yet any report from the Gas Committee upon a memorial sent to them by the Manchester and Salford Society for the Abatement of Obnoxious Vapours, in relation to the price of gas (see *ante*, p. 658). Mr. Smallmen observed that the present action against manufacturers in the city who turned out black smoke was likely to result in a desire to substitute gas for ordinary fuel in industrial processes. He therefore asked whether the Gas Committee would carefully consider the question of reducing the price of the present quality of gas, or of supplying a less expensive quality for manufacturing purposes. The Mayor mentioned that he had been memorialized to call a public meeting on this subject; but he thought it was not a question for such a meeting—the management of the gas, water, and other departments of the city being deputed to representatives of the people. The Gas Committee had been properly memorialized by the Society referred to; and no doubt the memorial would be reported upon in due course. After remarks had been made by other members, Alderman Lamb, the Chairman of the Gas Committee, said that hitherto it had been impossible to do what was desired with regard to gas for manufacturing purposes. So far it taxed the whole of the works to meet the present demand; but when they had increased the number of the retorts at the various stations, they would be in a position to consider an extension of the supply.

At a subsequent stage of the proceedings, Alderman Sir J. J. Harwood proposed the adoption of the report of the Gas Committee on the subject of electric lighting, the gist of which was given in his remarks. He said that a good deal might be argued on both sides of the question why the Gas Committee had not earlier availed themselves of their Electric Lighting Order. Ten years ago, he and other members of the Council reported upon the electric light question. Since 1881 he had, he believed, seen every installation of the electric light of any moment in England. The result of the inspection and inquiry of the present Committee showed that the utmost care was necessary in carrying out the Order referred to; and the Committee respectfully suggested that in the initial stages, with the view to obviate mistakes as far as possible, the best professional and independent advice should be sought to draw up a scheme including the most modern and economical appliances for carrying out the resolution of the Council. The Committee sought authority to select three or four electricians of reputation, to pay them 100 guineas each, and ask them to give in return the benefit of their knowledge and experience by saying which was the best mode of procedure, and the best kind of machinery to be employed in carrying out the Order. Such a course must present itself to the Council as being a most desirable one. The £400 or £500 expended in the initial stage would be money wisely spent. It would be only a small sum compared with the loss which would follow if in the commencement they made any serious mistakes. After the Committee had taken this step, they would probably wish to call in another professional person to assist them in coming to a conclusion. Under any circumstances, he thought it was going to cost them a great deal of money, and that there would be a serious loss when they commenced to supply the electric light. At Bradford the electric light had been sold at 5d. per unit, but there was a loss on the sale. A unit was about equal to 100 cubic feet of gas; so that 6d. per unit was equivalent to 5s. per 1000 cubic feet for gas. Besides this, the plant for the electric light cost three times as much per light as the plant for gas lighting; and there was no meter that could be relied on for measuring the electric light which could be obtained for less than £9. In Manchester they had gas of 19-candle power at 2s. 6d. per 1000 feet, while they would have to pay 5s. at the lowest price for an equivalent amount of electric light of 16-candle power; and beyond that, instead of a profit, there would be a loss. The electric light boom had been a grand deception. The great proportion of the money invested in it had gone into the pockets of the scientists, who had written articles in periodicals and newspapers, and puffed up the system everywhere; and another large amount had gone into the pockets of patentees and promoters. Under these circumstances, the Gas Committee had thought it right to hold their hands, and not rush hastily into an undertaking which their experience and investigations showed them must be practically ruinous if they entered into it on a large scale. The electric light could only be used as a luxury, and under very exceptional conditions; and how far the whole of the citizens would be justified in going into an undertaking for the few who could afford to pay for it, and who would use it as a luxury, was a matter which the Gas Committee had, in his judgment, wisely hesitated to decide. They would proceed with it at the wish of the Council on the distinct understanding that they were not to act rashly, but were allowed to act with every precaution. He therefore moved that the Committee be empowered to act with perfect freedom in their further proceedings. Mr. W. Brooks seconded the motion, and it was agreed to.

## METROPOLIS GAS SUPPLY.

### Recent Appeals to the Chief Gas Examiner.

(*Continued from p.* 653.)

*In the matter of the appeals of* THE GASLIGHT AND COKE COMPANY *against reports of the Gas Examiner at the Spring Gardens testing-place, of deficient illuminating power in the gas delivered by the Company on Oct.* 2, 9, *and* 13, 1890.

Each of these appeals was lodged within seven days after the day on which the respective reports were made. At the hearing which I gave to the parties in these appeals, Mr. Trewby appeared for the Company; Mr. Dibdin for the County Council.

It appeared that each of the reports to the Company showed the gas as not having an illuminating power above 15·5 candles. These numbers were obtained in accordance with the usual practice of the Gas Examiners, who cancel all figures below those in the first place of decimals, increasing by one the number in the first place, when the number below it is more than 0·05, and returning unchanged the number which stands in the first place of decimals when the number below it is less than 0·05. In each of these cases the number given in the report to the Company was obtained by cancelling a number which stood in the second place of decimals.

The Company contended that they ought, in accordance with the usual practice in their appeals, to have the benefit of any number standing in the second place of decimals, when the omission of such number would render them liable to forfeiture. The numbers obtained by the Gas Examiner for the illuminating power on the three days were: For the 2nd of October, 15·54; for the 9th of October, 15·52; for the 13th of October, 15·53.

It appears to me that in these cases, where the omission of a figure obtained in the second place of decimals would bring the Company within the limit of forfeiture, such figure ought not to be omitted.

The deficiency of illuminating power in the gas supplied by the Company at the Spring Gardens testing-place amounted to less than half a candle power on the 2nd of October, the 9th of October, and the 13th of October, 1890.

(Signed) ALEX. W. WILLIAMSON, Chief Gas Examiner.

*Feb.* 28, 1891.

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*In the matter of the appeals of* THE GASLIGHT AND COKE COMPANY *against the reports of the Gas Examiner at the Spring Gardens testing-place, showing deficient illuminating power in the gas delivered by the Company on Nov.* 1 *and Nov.* 3, 1890.

Each of these appeals was lodged within seven days after the day on which the respective reports were made. At the hearing which I gave to the parties in these appeals, Mr. Trewby appeared for the Company; Mr. Dibdin for the County Council.

The Company's case in each of these appeals was substantially the same as in the other appeals recently heard against reports of deficient illuminating power at the Spring Gardens testing-place. They stated that, according to their own tests, the gas was good at the time of these official tests. The Gas Examiner who had performed the tests was examined at some length by the Company; and it appeared from his evidence that the tests were performed with due care, and in accordance with the Instructions of the Gas Referees. The Company laid particular stress on the observations made by their officers as to the effect of the curvature of the wicks of the standard candles, upon the illuminating power of their flame, and consequently upon the apparent illuminating power of the gas which is being tested.

Their tests at Spring Gardens were made in the same building as that in which the official tests were made, and under the conditions which the Company urge as showing the really "normal" burning of the standard candles. It was stated by an officer of the Company who had examined the matter with considerable care, that a standard candle burning in such "normal" manner shows from 1 to 1½ candles higher illuminating power in the gas than a candle burning with a more bent wick. If, as must be supposed, the candle was in each case burning without smoke, the fact of such difference constitutes a serious objection to the use of such candles as affording a fixed standard of light.

The reports of the Gas Examiner at Spring Gardens testing-place, showing deficient illuminating power in the gas supplied by the Company on the 1st of November and on the 3rd of November, 1890, must be accepted.

(Signed) ALEX. W. WILLIAMSON, Chief Gas Examiner.

*March* 4, 1891.

### The Quality of the Gas in the Past Quarter.

The following is an abstract of the report of the Chief Gas Examiner as to the quality of the gas supplied by The Gaslight and Coke, the Commercial, and the South Metropolitan Companies, during the quarter ending the 31st ult.:—

I. *With respect to Illuminating Power.*—The average illuminating power, in standard sperm candles, at each of the testing-stations, was as follows:—

| | |
|---|---|
| The Gaslight and Coke Company— | |
| Jewry Street, E.C. | Closed |
| Cloth Fair, E.C. | 16·7 |
| Dorset Buildings, E.C. | 16·9 |
| Ladbroke Grove, W. | 16·4 |
| Devon's Road, E. | 16·5 |
| Carlyle Square, Chelsea, S.W. | 16·1 |
| Camden Street, N.W. | 16·5 |
| George Street, N.W. | 16·2 |
| Graham Road, E. | 16·6 |
| Kingsland Road, E. | 16·3 |
| Spring Gardens, S.W. | 16·4 |
| Grove Gardens, Regent's Park, N.W. | 16·4 |
| Hornsey Road, N. | 16·8 |
| Lambeth Road, S.E. | 16·1 |
| Millbank Street, S.W. (cannel gas) | 21·4 |
| Commercial Gas Company— | |
| Parnell Road, E. | 16·2 |
| Wellclose Square, E. | 16·1 |
| South Metropolitan Gas Company— | |
| Hill Street, S.E. | 16·2 |
| Foster Place, S.W. | 16·3 |
| Stoney Lane, S.E. | 16·3 |
| Lewisham Road, S.E. | 16·3 |
| Burrage Road, S.E. | 16·1 |
| Blackfriars Road, S.E. | 16·4 |

It will be seen from these results that the average illuminating power has been higher than the parliamentary standard at all the testing-stations of the three Companies, and especially at the Millbank Street station of The Gaslight and Coke Company. The photometer at the Jewry Street station was under alterations during the quarter.

II. *As regards Purity.*—Sulphuretted hydrogen was not present in the gas at any of the testing-stations. The proportions of sulphur in other forms averaged considerably less than the amount allowed per 100 cubic feet of gas at all the testing-places, and especially at the Millbank, Street and Devon's Road stations of The Gaslight and Coke Company

the two stations of the Commercial Gas Company, and the Bedford Road and Burrage Road stations of the South Metropolitan Gas Company. At these testing-places, the amount of sulphur present in the gas averaged less than half the quantity permitted. Ammonia was generally present in the gas throughout the quarter at all the testing-stations more or less frequently, but only in slight quantities. The amount allowed was not exceeded on any occasion during the quarter.

## INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Tuesday, at the Cannon Street Hotel, E.C.—Admiral Sir E. INGLEFIELD, K.C.B., in the chair.

The SECRETARY (Mr. L. de Fonblanque) having read the notice convening the meeting, the report and accounts were presented.

The CHAIRMAN said that before he moved the adoption of the report and accounts, he would make a few observations which would be interesting to the shareholders. It would probably be remembered that the Directors had intimated their intention of preparing a balance-sheet up to June 30, 1890, for the purpose of starting the Company from that date on a new basis. They found, however, that it would be necessary to extend this time to July 31, as before that date it would have been impossible to have closed the outstanding transactions and liabilities. It would be seen by the accounts now submitted that the business from Jan. 1 to July 31 last had resulted in a heavy loss. The cause had been touched upon in the report accompanying the accounts, so that it was only necessary to briefly recapitulate how it came about. The present Board took office immediately after the financial reorganization of the Company; and their first duty was to ascertain the exact position of the concern. In the accounts passed at the meeting held on May 23, 1890—viz., those for the year ended Dec. 31, 1889—a certain amount was written off for depreciation of stock. When this was done the Directors and the then newly-appointed Manager (Mr. I. Moeller) had not had an opportunity of making themselves thoroughly acquainted with the value of the stock in hand. On going into the matter, however, they found out that the enormous stock of glass was practically valueless; and the same remark applied to a large quantity of brass-work. The book debts, which had been estimated to produce £5000 were found to be worth no more than £2000; and from the date of taking office after the subscription of the new capital, the Directors found themselves compelled to keep paying out large sums in liquidation of liabilities previously incurred. Had all this been brought to their knowledge at an earlier date, the large sum which figured as the loss on the working from Jan. 1 to July 31 last might have been wiped off in the reduction of capital, so as to enable them to start with a clean sheet. But the reduction was based upon the figures of the balance-sheet for the year ended Dec. 31, 1889; and the loss must, therefore, appear in the accounts submitted. The actual working loss had been further augmented by the extravagant establishments which were being maintained by the Company when the present Board took office. He was happy to state that these had been got rid of; and in the one item of rent alone they had reduced the standing charges from £1737 to £240 per annum. With regard to the business, the lamps supplied last season, while in many respects greatly superior to the pattern before sent out, had been found capable of great improvement; and this, which would also lead to economy in the cost of production, would be embodied in the burners to be issued in the coming season. While from July 31 to Dec. 31, 1889, 8300 lamps were sold at a charge of 7s. 6d. each, during the same period in 1890, 15,800 were sold at a charge of 10s. each. It would therefore be seen that a very considerable impetus had been given to the business. The Directors estimated that in the present year economies would be effected to the extent of £6000 per annum as compared with the past twelve months. The Manager had visited the Welsbach Companies in Austria and Berlin; and the Directors had also been in communication with the American Welsbach Company. The result of this intercourse was that they received several suggestions and had many opportunities of improving their system of lighting. It would be in the recollection of the shareholders that when they last met the Company were in litigation with Mr. Mactear with respect to certain agreements. This dispute had been settled out of Court, on terms which the Directors had been advised were the most advantageous for the Company. In fairness to Mr. Mactear, the Directors wished to state that the personal charges made against him were, to their minds, quite without foundation; and in order to express their opinion in this respect, they, as part of the terms of the settlement, appointed him Consulting Chemist to the Company. He, however, while accepting the position, resigned it almost immediately, and had now no official connection with the Company.

Major MUNDY considered that the fact that the Army and Navy Stores used the Company's lamps was a great advertisement. He was, however, sorry to learn that the light was not liked by the officers there.

The MANAGER pointed out that there had been some difficulty in the lighting on account of the regulator used; but he believed the officials at the stores were now satisfied.

The CHAIRMAN formally proposed the adoption of the report and accounts; and the motion was carried unanimously.

The thanks of the meeting having been accorded to the Chairman and Directors, as well as to the Manager.

Mr. MOELLER, in acknowledging the compliment to himself, assured the shareholders that the Company had now very good prospects. They were in communication with the British Water Gas Syndicate, with regard to supplying their lamps to them; and it was under consideration whether or not two small towns in Yorkshire should be lighted with water gas consumed by incandescent burners. If the Syndicate obtained the contract, it would mean an output of about 15,000 more lamps a year.

The proceedings then terminated.

**Cookery Lectures at Belfast.**—During the past week, Miss H. M. Young, of Warrington, gave a series of lectures on cooking by gas in the Gas-Works Hall at Belfast. For her demonstrations (which were very interesting and successful) she used Fletcher's cooking-ranges.

## EAST LONDON WATER-WORKS COMPANY.

The Half-Yearly Assembly of Proprietors was held at the Company's Offices, St. Helen's Place, E.C., last Tuesday—Mr. A. W. GADESDEN in the chair.

The SECRETARY (Mr. I. A. Crookenden) read the notice convening the meeting, and the report of the Directors, an abstract of which appeared in the JOURNAL last week, was taken as read.

The CHAIRMAN said he thought he might state that the report and accounts were eminently satisfactory. The revenue of the Company continued to increase; and although it was quite true that the expenses were somewhat greater, it must be borne in mind that those incurred in the half year under review included the cost of the opposition to the Tottenham and Forest Gate Junction Railway Company's Bill of last year, as well as the extra expenditure for fuel, wages, &c., and that, in addition, a largely increased quantity of water had to be pumped last winter in consequence of the severe weather. The public seemed to entertain the idea that when there was frost the Water Companies saved by it. He had therefore asked the Engineer (Mr. W. B. Bryan, M. Inst. C.E.) to put down for him the results of the frost so far as the Company was concerned; and he would read what Mr. Bryan stated. It was as follows:—

> From the first week in December to the last week in February inclusive, the enormous volume of 823 million gallons over and above the corresponding period of the previous year was pumped. The week of maximum supply was that ending the 23rd of January, when 370 million gallons were pumped. This would suffice to fill a canal 188 miles long, 20 feet wide, and 3 feet deep. The actual amount of work done was equal to raising 1,650,000 tons weight 140 feet high. The greater proportion of this water was wasted. There were many thousands of burst lead pipes running during the frosts, which caused the greatest trouble in giving water to the high supplies. The Company employed a large number of extra men to fix stand-pipes in the district, with a view of minimizing to some extent the great inconvenience consumers were put to by their fittings being frozen. It was very difficult to make a consumer understand that the Company's pipes were not frozen, although the flow from the stand-pipes was evidence that they were not. The applications to have the water shut off for repairs to fittings were so numerous, that it was absolutely necessary to turn on the water in some districts for only three or four hours daily; leaving the plumbers the rest of the day to execute the necessary repairs. If each individual consumer had had the water turned off to suit his time and convenience, the water would have been practically shut off altogether. The officials were abused for not shutting it off; and they were also abused for shutting it off. Many burst pipes are not yet repaired. The out-door staff were at work many weeks night and day, and Sundays also, with very little rest, during the whole period of the frosts; the result being that a number of the men were laid up. The frosts have cost the Company a very large sum in extra coals for pumping, wages, repairs to pipes, &c.

This statement would give the proprietors a very fair idea of the difficulties which a Water Company had to contend with when there was a frost. It was a subject of sincere congratulation that the Company were within measurable distance of finishing the great works they had in hand. The completion of one of these—their new pumping-station at Lea Bridge, which had been erected to afford the supply that used to be given from Old Ford—had been very nearly reached. In a few days the first engine would be put to work experimentally; ten days later the second engine would be started; and this would be followed, after another interval of ten days, with the third and last engine. These engines represented the highest possible mechanical efficiency which the Directors were able to provide with their knowledge up to the present time. The work itself was very fine, and did immense credit to the Engineer and those who had executed it. To enable the proprietors to form some idea of the power of these engines, he would state that they were capable of pumping into the Company's district upwards of 40 million gallons of water in 24 hours; and he might also mention—and this point of itself was of interest—that their pumping-station at Lea Bridge would be the largest of such establishments in Europe. With respect to the wells, very good progress had been made. The one at Lea Bridge was sending into the district more than 3 million gallons of water in 24 hours; and with a little further driving into the chalk, this quantity could be increased. He therefore thought they might consider this well a great success. With regard to the Walthamstow well, which had given the Directors a considerable amount of trouble and anxiety, all the difficulties had been surmounted. All they had now to do was to further excavate the chalk, and in a comparatively short time they might look to have this well in operation. The permanent engine was fixed. With respect to their wells, therefore, they might consider that they had fairly overcome all difficulties, and that they would prove a great success. On a former occasion he had stated that the Directors fully believed that their three wells would yield them 10 million gallons of water per 24 hours; but it was quite clear that they would exceed this quantity. The new offices at Lea Bridge were also completed. As regarded the dividend, the Directors were very pleased indeed to meet the proprietors with a dividend of 8 per cent. This amount had been fairly earned in the past half year; and he did not think there was any reason to suppose that, when they met six months hence, they would not be in a position to recommend a similar dividend. It might, perhaps, interest the shareholders to know that it was 38 years since they were able to declare the same amount. He might add that all the other works of the Company were in as good a condition as possible. The well at Waltham Abbey continued to give the greatest satisfaction—working admirably, and yielding a good supply of excellent water. There was "a little bitter in the cup," in the paragraph of the report referring to the possible legislation in reference to the transfer of the undertakings of the Metropolitan Water Companies to the London County Council. If Parliament decreed that the time had arrived when, in the interest of the ratepayers, this transfer should take place, the Companies would, of course, have to bow to the inevitable; but as the transfer would be made for the benefit of the ratepayers, he could not for a moment imagine that the Companies would not, in the end, be fairly—he would not say liberally—dealt with. The supply of water had been furnished to the community by these Companies, who had thoroughly well fulfilled their important duties; and it would be hard indeed if, for the supposed pecuniary benefit of the ratepayers, they were to be pushed on one side, and any-

thing like confiscation attempted. He concluded by moving the adoption of the report and the payment of a dividend of 4 per cent., less income-tax, for the past half year.

Mr. H. DALTON seconded the motion.

Mr. R. EYKYN inquired if any intimation had been given to the Directors, by those who are practically dealing with the transfer of the Companies' property, to the effect that the interests of the proprietors were to be recognized by the Chairmen, or some equally competent authorities, being placed upon the Committee. Having some knowledge of parliamentary life, he did not think it likely that the Legislature would deal with the Companies in a confiscatory manner. He nevertheless thought it would be a great advantage if they had the benefit of experts on a Committee which was to investigate their position.

Mr. F. TENDRON said he assumed that each of the Companies would be strongly represented by counsel and others, and that all matters affecting their interests would be brought before the Committee, and thoroughly explained. He felt sure, therefore, that their interests were perfectly secure, if no cowardice was displayed on the part of the shareholders or Directors. Certainly not in a country like England could the great services which had been rendered by the Water Companies be disregarded. As to the idea which had been brought forward by some interested people as to valuing the water undertakings at what they were worth for selling purposes, this was a point which the Companies would not think of entertaining. They were in receipt of a certain income, and they had certain advantages; and no honourable Government would ever attempt to take these away without giving the possessors of them as large if not a larger return than they were now receiving. Several of the Companies had incurred heavy expenditure solely for the advantage of the public; and whether or not the public would gain by the transfer of their businesses to inexperienced hands was a very great question. But when the public had a "fad" in its head, it was easily led astray.

The CHAIRMAN, in reply, stated that the Companies would take care that their case was properly and fairly laid before the Parliamentary Committee. It might be interesting to the proprietors to know, in view of the dividend recommended on the present occasion, that the average rate which the Company had paid since its inception some 90 years ago had only been 5¼ per cent. per annum—a very moderate dividend, he thought, considering the risks which had had to be undertaken.

Mr. TENDRON, referring again to the forthcoming inquiry, said he thought it would be a proper thing for the Chairmen of the several Companies to wait upon Mr. W. H. Smith with the view to a representation of the Companies upon the Committee.

The CHAIRMAN said the Directors would take care that the matter was not lost sight of.

The resolution was then carried unanimously.

The retiring Directors (Messrs. A. W. Gadesden, J. H. Nix, and G. Banbury) were next re-elected, as was also Mr. F. Tendron, the Auditor.

The usual votes of thanks having been passed, the meeting was brought to a close.

## ANTWERP WATER-WORKS COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Thursday, at the London Offices, No. 86, Cannon Street, E.C.—Mr. CHARLES CREW in the chair.

The SECRETARY (Mr. W. Conway) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read. From these it appeared that the income of the Company from all sources amounted to £21,671, as against £20,666 for 1889; and after deducting working expenses, the cost of laying on services, and debenture interest, the net revenue was £8551, which, added to the balance of £204 brought forward, and charging 5 per cent. on the net profits for reserve fund, left the sum of £8327 available for division. Out of this the Directors recommended a dividend at the rate of 2½ per cent. per annum, free of income-tax.

The CHAIRMAN said he considered the report was both unsatisfactory and satisfactory. Unsatisfactory in this way—that they had to record a great calamity which had happened to the Company during the past winter, and which had interfered with their progress and prosperity to a certain extent. He referred to the severe frost which had been experienced, and which had done considerable damage to their distribution system. The mains, however, had now been put in order; but at an expenditure of something like £3000. Although they had to face this trouble, the Company had made substantial progress; and this was very satisfactory. Their income from all sources showed an increase of £1005; and with regard to the capital account, there had been an expenditure during the year of £1633. Of this, £1453 was for extensions of mains; and they were expecting to realize on this outlay from 15 to 20 per cent. The balance of capital account was £1874; and this would only be about sufficient for the extensions required during another year. They would therefore have to issue more debentures—say, £5000—to keep them going for a time. During the past year they had had to pay 5 frs. per ton more for coal than in 1889; and he was much afraid they would have to face still higher rates, as, unfortunately, the strike mania seemed to be spreading in Belgium. With regard to the frost expenses, the Directors had charged a proportion (£200) to the reserve fund. He wished here to recognize the generous manner in which the Gas Company at Antwerp and the Municipality had come forward and assisted them during that time of difficulty with material and labour; and he added that the Directors had that day passed a special vote of thanks to those bodies. He next spoke of the growing activity at the Port of Antwerp, and stated that in the future they were likely to have a good increase in revenue from the shipping. Last year he mentioned that their meter customers were going in for artesian wells; and they were still developing the system for trade purposes. The Company could not compete with these wells; but, on the other hand, the continual increase in the number of houses they supplied, counterbalanced the loss. He went on to speak of the efforts which were being made to introduce electric lighting into Antwerp. It was proposed to distribute hydraulic power for driving the dynamos in small local stations; and as the Company had the monopoly of the distribution of water for both hydraulic purposes and consumption, they were approached by those interested in the project. As a result of negotiations, the Directors had entered into a conditional agreement, by which the Company were to be paid for the water used a minimum sum of £500; and if the scheme was fully developed, it was estimated that they would realize about £2000. The Gas Company, who had a monopoly of both gas and electric lighting, had also entered into an arrangement with the promoters of the scheme. In conclusion, he proposed a resolution adopting the report, declaring a dividend of 2½ per cent., and authorizing the transfer of £400 from the balance to the amortization fund.

Mr. HORNER seconded the motion, which was unanimously carried.

The retiring Directors were Messrs. Crew and Norman. The first gentleman was unanimously returned to his seat; but on the motion for the re-election of Mr. Norman, a direct amendment was proposed by Mr. Weir on the ground that he could not possibly carry out his duties properly as he was a Director of a number of other companies. The amendment, however, was negatived; and the motion was adopted by a large majority.

The Auditors having been re-appointed,

Mr. Ad. KEMNA, the Manager of the Company, addressed the meeting at some length on the troubles which they had experienced in Antwerp during the past winter through the frost.

The proceedings then terminated.

## THE NEW WATER SUPPLY SCHEME FOR BIRMINGHAM.

At the Meeting of the Birmingham City Council last Tuesday—the MAYOR (Mr. Alderman Clayton) presiding—the report which the Water Committee have drawn up with reference to the proposed scheme for deriving a supply of water from the Rivers Elan and Claerwen in Radnorshire, was brought before the members.

The report is a lengthy document, and is divided into four sections, headed: (1) "As to the necessity for new works;" (2) "New sources of supply;" (3) "Finances;" and (4) "Concessions and recommendations." The preface states that the resolution authorizing the Committee to consult with Mr. James Mansergh, "as to further powers to be obtained by the Corporation with reference to the additional works and sources of water supply necessary to meet the future requirements of the district supplied by the department," was passed by the Council on Oct. 7, 1890. The Committee at the outset asked both Mr. Mansergh and their own Engineer (Mr. J. W. Gray) to report to them what works they would recommend for giving the department such an additional water supply as would, with the existing sources of supply, provide for periods of 25 and 50 years respectively. The reports received from these gentlemen show that they are in complete agreement, both as to the immediate need for new works, and as to the scheme they recommend for meeting the growing requirements of the district.

In dealing first with the question of the necessity for new works, the Committee state that in 1876 the supply of water amounted to 3031 million gallons, or an average of 8·30 million gallons per day; and in 1889, to 5211 million gallons, or 14·28 million gallons daily. Mr. Gray estimates that in 25 years' time (1915) the consumption will amount to 10,950 million gallons, or an average of 30 million gallons per day; and in 50 years' time (1941), to 16,425 million gallons, or 45 million gallons daily. So that, according to this estimate, it may be anticipated that the supply will double within the period of 25 years, and treble within 50 years from the present time. To meet these demands on the resources of the department, the average yield from streams and wells is about 20¼ million gallons per day. In a dry season it amounts only to 17½ million gallons per day. It is therefore obvious that steps must be forthwith taken to obtain fresh sources of supply. Mr. Mansergh sums up his statement on this part of the subject as follows: "25 years hence, therefore, the present means of supply (equal now to 20¼ millions) would require to have been augmented by, say, 11 millions a day, and 50 years hence by 38 millions."

The second section of the report is divided into two parts—local and distant sources of supply. As to the first part, at an early stage of the inquiry, Mr. Gray submitted to the Committee some suggestions for developing the present works of the department, so as to increase as far as possible the supply from the existing sources. The works so suggested, in addition to some extension of the system of deep wells, consisted mainly of a series of reservoirs to be constructed in the valley of the Bourne; the object being to impound the flood-waters of that river, and so utilize large quantities of water which at present are allowed to pass down its channel. Mr. Gray estimated the total cost of these works (including some incidental increase of engines, filter beds, and mains) at nearly £1,000,000. The scheme, however, appeared to the Committee to be open to very serious objections; and they therefore found it necessary to turn their attention to the desirability of seeking a supply from fresh districts. They remind the Council that in the year 1871 an elaborate report on the whole subject of the Birmingham water supply was prepared by order of the Council by Mr. (now Sir) Robert Rawlinson. A large part of the very full information contained in that report is just as applicable to the circumstances of to-day as to those of twenty years ago. At that date the water undertaking was vested in the late Company; but the Council had already had under consideration the question of acquiring it, and had in the Improvement Act of 1851 taken powers for the purchase. The elaborate investigation by Sir Robert Rawlinson led him to the conclusion, as stated in his report, "that an examination of the country within a circuit of 100 miles shows that the district fulfilling best the necessary conditions of ample area, non-pollution, and sufficient elevation, is part of the watershed of Mid-Wales—the rivers Elan and Claerwen, in the counties of Cardigan and Radnor." Sir Robert accordingly recommended that a supply be obtained from the district named; and that, in order that the Corporation might be placed in a position to carry out the necessary works, steps should be taken for purchasing the undertaking from the Company. No active measures were then taken, or have since been taken, to carry out

the Elan and Claerwen scheme. It was on too large a scale for the Company to undertake. The Corporation did not acquire the water-works till nearly five years after the date of the report; and, by developing and extending the system of works taken over from the Company, they have hitherto been able to maintain and improve the water supply of the district without having recourse to any such scheme as was recommended by Sir Robert Rawlinson. It appears that Mr. Mansergh, then a junior partner in the firm of Lawson and Mansergh, assisted Mr. Rawlinson at the time of his inquiry in 1871, by making surveys and obtaining information for him; and on these his report was, to a large extent, based. Mr. Mansergh had, therefore, an early opportunity of becoming acquainted with the valleys of the Elan and the Claerwen. At the present time, when he has approached the matter independently, and with the benefit of his subsequent experience, he has come to the same conclusion as Sir Robert Rawlinson did in 1871. Mr. Mansergh says in his report: "I have given the matter my most thoughtful consideration, and am satisfied that there is no place comparable to it [the district in question] in suitability for Birmingham on any of the English rivers, and that you must go over the border into Wales if you are to get a thoroughly satisfactory supply, and that of all the Welsh streams the Elan and the Claerwen are by far the best." Mr. Gray entirely agrees with this opinion. If this area should be adopted it will be possible, say the Committee, to construct the storeage reservoirs at such an elevation above the level of the sea as will allow of the water flowing by gravitation to Birmingham, so that it could be delivered in the Monument Road reservoir without the necessity for any pumping whatever; and it is calculated that the saving in the cost of pumping will amount to about £20,000 a year. The distance from the Elan to Birmingham slightly exceeds 80 miles. The Committee are satisfied that the purity of the water, its sufficiency in quantity, and the absence of danger of future contamination are all that can be desired; and if the proposed works are constructed, there seems to be no question that they will afford Birmingham an ample supply for the next fifty years.

On the financial aspect of the scheme, the Committee are at present without any definite estimate of cost from the Engineers, and none can be made, so as to be fully reliable, until a detailed survey has been completed of the lands affected by the scheme. They are not, however, without some figures on which to base their calculations, as Sir Robert Rawlinson's report contains rough estimates of the cost of carrying out the scheme, varying the amounts according to the quantity of water required. Taking these estimates as a basis, the Committee entertain strong hopes that it will be found that the scheme can be carried out without levying any rate-in-aid, and without any alteration in the parliamentary scale of maximum water-rental, provided that for a time an increase be made in the water charges. Such increase, however, would be within such limits as to represent a portion only of the amount of the reductions made in the rentals in 1881, 1883, and 1884; so that the consumers would still have water supplied at a cheaper rate than when the undertaking became the property of the Corporation. The Committee proceed to explain how this can be done. At the outset it is desirable, they say, to bear the following facts in mind: 1. The steady growth of the income of the department from the water-rental. 2. The execution of the works can be spread over a number of years. This is fully explained in Mr. Mansergh's report. The result, of course, will be that the annual charge in respect of the capital outlay will increase gradually, and not come on immediately. 3. That, according to the precedent of the Manchester Act of Parliament, it is expected that no payment in respect of sinking fund will be required for the first ten years from the passing of the Act. 4. That as soon as the works are sufficiently advanced to provide for a supply of water by gravitation, a sum of money (estimated by Mr. Gray at £20,000 a year) will be saved from the cost of pumping. It will be well, the Committee remark, to give an illustration of the financial working of the scheme as affected by these considerations; but before proceeding to do so, they remind the Council that the accounts of the department showed a deficiency on Dec. 31, 1889, of £17,144. It is, however, anticipated that the profits of the current year and the next following financial year will be sufficient to clear this off; so that from March 31, 1892, it will no longer be necessary to apply the profits in reduction or discharge of this deficiency, but they will be available for the expenses of the scheme. It is proposed to increase the income in 1892, and thenceforward so long as may be necessary, by beginning in that year the suggested increase in the scale of charges. As to the capital expenditure, Sir Robert Rawlinson estimated that for a supply of 20 million gallons a day (the masonry conduit being sufficiently large to convey 40 million gallons), the capital outlay would be £1,586,420; and that for supplying 40 million gallons it would be £2,458,120. In each case the item of interest on capital during construction, which in the estimate was added to the cost, is here omitted, as the present scheme is framed on the basis of such interest being discharged as it becomes due. In the present scheme, it is proposed that the masonry conduit should be made large enough to convey 60 million gallons, and that two out of the five mains for crossing the valley, which will ultimately be necessary to deliver that quantity, should be constructed at once, the others following as required. The difference in the size of the conduit, as well as the increase in the cost of labour, will, of course, materially affect the estimate. The Committee include in this portion of their report some information which has been obtained as to the two similar undertakings of Liverpool and Manchester; and then they say that, on the whole, having before them Sir Robert Rawlinson's rough estimates and the facts as to experience elsewhere, and acting under Mr. Gray's advice, they considered it would not be unfair to take, for the purposes of the proposed illustration, a sum of £4,000,000 as the probable cost of the scheme, and to assume that the outlay would be completed in 1901. It should be observed that this supposition provides for a much more rapid expenditure than is contemplated by Mr. Mansergh, who says interest on the third pipe might "be saved for perhaps twelve or fourteen years, on the fourth for twenty-seven years, and on the fifth for nearly forty years." To this extent, therefore, the present calculation is made on the safe side. It is proposed that the annual profits which may be expected during several years after March, 1892, and which will be increased by the proposed temporary addition to the charges, as well as by the natural growth of the rental, shall be retained and accumulated until the fund is wanted to meet the deficiencies which for a time will arise on the annual accounts; and it is proposed so to adjust the amount of increase to be made in the charges as to provide, as far as can be anticipated, for these annual deficiencies while they last. The time will, of course, come when, the expenditure having ceased, but the income continuing to grow, the claims on the accumulated fund will become smaller and smaller until they cease altogether, and the accounts again show a profit. Messrs. Howard Smith, Slocombe, and Co., the Auditors of the department, have, under the instructions of the Committee, worked out complete calculations on the lines of the foregoing financial scheme. The amount and rate of capital expenditure given to them were those assumed by Mr. Gray for the purpose of his calculations. They were instructed, however, to make their own estimate of the future growth of the water-rents, based, of course, on past experience. They take 3 per cent. per annum as the basis of their calculations of such growth; the increase in 1889 having been at the rate of 3⅓ per cent., and the average increase since 1876 at 4½ per cent. per annum. The probable increase of expenses of various kinds has also been prepared by them and taken into account. Their calculation requires the restoration to the rental of a sum of £24,000 per annum, which is rather more than two-thirds of the reductions heretofore made. With the assistance of this increase, a considerable surplus would be secured in the year 1892; and this sum, with the addition of the surpluses in following years, would continue to grow until it reached the maximum in 1898. From this time for several years, owing to the progress of the expenditure on the works, deficiencies of varying amounts are anticipated. In 1901 and 1902, owing to the completion of the works, the saving in the cost of pumping begins to tell. On the other hand, in 1903, the first payment for sinking fund is brought into the account. The general result, as shown by the account, is that the fund accumulated in the early years is sufficient to meet all the annual deficiencies until 1907. In the two following years, the account would be overdrawn to a small extent; but in 1909 the tide again turns, and a surplus is anticipated of £2313. From this time forward, annual and growing profits may be expected. This forecast, being based on an amount of capital expenditure which is not the result of actual valuation, must be taken as given rather as an illustration than a prediction of financial results. It will, however, suffice to show the general nature of the financial scheme proposed. If it should happen that the capital outlay should be less than the £4,000,000 which has been named, a corresponding reduction would have to be made in the £24,000 a year it is proposed to add to the water-rental. If it should be more, a corresponding increase must be made. There is, however, a considerable margin within the limits of the remission of charges which is available for covering any excess in expenditure beyond the sum assumed. The calculation also will be largely affected if it should be found that a portion of the works can be postponed beyond the dates suggested by Mr. Gray. In this connection the Committee observe that, while the capital expenditure has been estimated to amount to half a million a year (after 1894), this amount has never in any one year been reached by either the Liverpool or the Manchester Corporation in carrying out their schemes. For the reasons above stated, the Committee believe there are good grounds for anticipating that the cost of carrying out the proposed works can be provided from the resources of the department itself without extraneous aid, and by an addition to the scale of charges which would be at once moderate and temporary.

After giving the whole matter their most anxious consideration, the Committee, who at the outset of the inquiry anticipated that the needs of the district might be met by a development of local resources, have gradually arrived at a decided conviction that it is for the best interests of Birmingham that the Elan and Claerwen scheme should be adopted, unless, in the course of the further investigation which will be necessary, some insuperable financial or other difficulty should arise. If the Council should adopt this view, the next step will be to instruct the Engineers to proceed to make a detailed survey, with the view of ascertaining the precise nature, situation, and extent of the various works, and of making a complete and reliable estimate of the cost, and of the probable times at which the expenditure must be made. The Committee are deeply impressed with the necessity, if the project be entertained by the Council, that such steps should be taken as will put them in a position to submit a Bill for the requisite powers to Parliament in the session of 1892. Considering the magnitude of the works, much time will necessarily be occupied in the technical preparations for such a Bill; and in the opinion of the Committee it is necessary that some progress should be made in these preparations, even before the Council has had an opportunity of considering the further reports to be supplied by the Engineers. The Committee therefore recommend as follows: "1. That they be authorized by the Council to obtain from the Engineers as soon as possible further reports as to the works proposed and estimates of their cost, and to submit the same to the Council. 2. And that they be also authorized in the meantime to proceed with the preparations for the proposed Bill, and for that purpose to obtain all such professional assistance as they may consider necessary.

Appended to the Committee's report are those of Mr. Mansergh, Mr. Gray, Dr. Hill, and Messrs. Howard, Smith, and Slocombe. That of the latter firm deals with the finances of the scheme, a summary of which is given in the report of the Committee. Dr. Hill's report embodies the results of analyses of water from below the junction of the Elan and Claerwen, near Rhayader. He states that "it is a pure and most excellent water for all practical purposes, domestic and otherwise, and shows what may be considered absolute freedom from animal pollution, while its great softness is a great economical recommendation, both as regards cooking and washing, to say nothing of boiler use and industrial applications in general." Mr. Gray's report deals with the present supply, and local and possible sources of supply. It is fairly covered by the Committee's report, so that further reference need not be made to it. In Mr. Mansergh's report, he describes the scheme from an engineering point of view as far as this can be done at the present stage. He says the watershed of the Elan and its tributaries above a point 70 chains down from the junction of its principal affluent, the Claerwen, has an area of 45,000 acres

At that point the height of the bed of the river is 700 feet above Ordnance datum or mean tide level. It is 80 miles nearly due west from Birmingham. The highest part of the watershed rises to 2100 feet. Very nearly the whole area is unenclosed mountain pasture—the whole population upon it cannot be more than 180; and he thinks it would be difficult to find a similar area in England and Wales equally free from any sources of pollution. The district is competent to furnish for supply in Birmingham all the water that he estimates will be required fifty years hence, after providing a proper amount of compensation water to the river. He proposes to place the first dam across the Elan at the point before mentioned, at 700 feet above Ordnance datum; forming here the compensation reservoir with its top water at 800 feet. This is an exceedingly fine site, as the water would be backed up the Claerwen 2 miles above the dam and 3¼ miles up the Elan; forming a lake covering an area of 380 acres. At present there is no information available to enable Mr. Mansergh to estimate the contents with sufficient accuracy to put it into absolute figures; but he thinks it will probably approach 4000 million gallons. A little below where the top water of the compensation reservoir would tail out in the Elan, the dam of the first reservoir for supply would be constructed, the invert of the draw-off conduit to Birmingham being placed about 820 feet above Ordnance datum. Above this reservoir others can be constructed on the Elan as the demand for water increases in the future. Upon the Claerwen the first supply reservoir would be formed at such a level as to fit it for passing its stored water into the lowest supply reservoir on the Elan by means of a catch-water channel or tunnel, taking in several tributary streams on the way. Above that again there are sites for other reservoirs to be utilized as required. If the reservoirs that will be required twenty or thirty years hence on the higher parts of the Elan and Claerwen prove, on investigation, exceptionally costly, it may be desirable now to secure the Upper Wye area referred to in the 1871 report. The conduit from the Elan to Birmingham cannot be described at the present stage in any detail. Mr. Mansergh's impression, however, is that in the total length of about 80 miles from the Elan to the large service reservoir which will have to be made a few miles out of Birmingham, there will be about 8¾ miles of tunnel, 35¾ miles of cut-and-cover work, and 34½ miles of iron pipes in crossing valleys. The tunnels and the cut-and-cover work will be made large enough to convey the full quantity of water procurable from the watershed; but the valleys will be crossed by iron pipes working under pressure, each competent to convey one-fifth of the total ultimate quantity. One of these will be designed to deliver about as much water as the present sources furnish; and as these will be abandoned in favour of the new gravitation supply, a second will have to be laid at the outset to provide for growing demands. The three other pipes would then be laid at succeeding dates, as the necessity arose. Bridges would be built across the rivers, at a reasonable height above the water, wide enough to carry the five pipes. At convenient places upon the line, small break pressure tanks will be introduced, and about half-way along the conduit he proposes to construct a reservoir to hold (say) 100 million gallons, to provide for short temporary stoppages in the conduit above. The first works to be put in hand would be the conduit, with all its accessories, the compensation reservoir, and one supply reservoir upon the Elan.

Alderman Sir THOMAS MARTINEAU, the Chairman of the Water Committee, moved the adoption of the recommendations in the report—that the Committee be authorized to obtain further reports on the scheme from Mr. Mansergh and Mr. Gray, together with estimates of the cost of the necessary works, and, in the meantime, to proceed with the preparation of plans, references, and other things necessary to enable the Corporation to promote a Bill before Parliament in the session of 1892 for the purpose of carrying out the proposal, engaging such professional or other assistance as they may consider necessary or desirable. Sir Thomas spoke for nearly two hours; but his speech was mainly a recapitulation of what was contained in the report, so that a great deal of space need not be devoted to it. He said that the Committee were absolutely unanimous in making the recommendation he had just moved. In their estimates they necessarily had to indulge in a certain amount of prophecy. The only rule they had to go by was what had already happened in the past; and fortunately in drawing up the estimates they had had a very good guide in Mr. Gray, who had been for 25 years connected with the water supply of the city. There was one reason why they should not dally with this matter, but should go at once to Wales if they went at all; and that was the action that was being taken by London. The County Council had petitioned the Government to institute an inquiry as to the best sources of supply for the Metropolis; and they were also making inquiries themselves. A report had been presented to them by Messrs. Hassard and Tyrrell, who had advised them to obtain their supply from the head waters of the River Wye, including the tributaries of the Elan and Claerwen. No doubt London had only reached the initial stage, and that a great deal would have to be done before a Bill could be put into shape, or before the actual sources of supply were decided upon. Therefore Birmingham had a little time before London became a rival; but it must be borne in mind that London would be a rival sooner or later. The Council would see the force of the reason he had mentioned for urgently pressing on with the matter, so that in 1892 they might present their Bill to Parliament, and, he hoped, without any rival community seeking the same source. Dealing with the construction of the proposed works, he said that one of the great troubles of the Water Department had been the expense of pumping water from the lowest level to the highest part of the city, which was more than 600 feet above the level of the sea. What they hoped to do was to place their reservoir so high that the water could flow, without any pumping at all, down to Birmingham. As regarded compensation, it was proposed to erect an enormous dam at Caban Coch, which would have the effect of backing up the Elan and Claerwen—the former for 3¼ miles and the latter for 1¼ miles. When the scheme was complete, it would be necessary to have further reservoirs in each of the valleys, in order to maintain the streams at their proper elevations. The water from the reservoirs would be carried to Birmingham by a great conduit. For the purposes of the valleys there would be mains carried down the one side, across the river at the bottom, and up the opposite side, the water finding its own level and joining the conduit beyond. The Severn would be crossed by an aqueduct, with the mains on the top of arches. As to the cost of the works, Mr. Gray considered that about £4,000,000 would be sufficient as capital outlay. But this was only an illustrative sum; and they could not tell the exact amount until they knew what the precise works would be. He concluded by remarking that he thought many members of the Council, who had spent the greatest part of their public lives in the service of the town, would feel a proud satisfaction in thinking that this matter rested with no board of directors anxious to make a dividend for a set of hungry shareholders, but with the representatives of the people, backed with all the force of a powerful Municipality, and with no object to gain, no interest to serve, but the greatest possible good to the population whom they represented.

Mr. PEMBERTON seconded the motion.

Mr. GRANGER hoped a vote would not be taken that day; for the reason that the public would then have the opportunity of reading the speech of Sir Thomas Martineau. Whilst it was possible that the scheme would be of advantage to the town, there might be drawbacks in other respects; and improvements which would be necessary to the growth of the town in future might be prevented in consequence.

Mr. TOWLER considered the Council ought to have some more information before being called upon to vote.

Alderman JOHNSON expressed the hope that the decision would not be postponed. The report and the proposals of the Committee had been before the ratepayers for nearly a fortnight; and everybody appeared to agree that they did require an additional supply of water.

Mr. JACOBS proposed that the debate be adjourned for a fortnight.

The proposition having been seconded,

Sir THOMAS MARTINEAU intimated that the Committee had no objection to it. He was glad, however, that it was to be for a fortnight only, as they had an enormous amount of work to get through. The sooner they could commence work, with the authority of the Council, the better.

The adjournment was agreed to by 26 votes to 10; 12 members remaining neutral.

On the motion of Sir THOMAS MARTINEAU, a resolution was passed sanctioning the borrowing of a further sum of £50,000—the remaining portion of £100,000 which the Corporation were authorized to borrow under their Water Act of 1875.

## THE LONDON COUNTY COUNCIL AND THE WATER SUPPLY.

### The Council's Water Bill.

In the "Parliamentary Intelligence," in the JOURNAL for the 24th ult., we recorded the presentation of a Bill in the House of Commons, by Sir J. Lubbock, Mr. Howard Vincent, and Mr. Lawson, to "confer powers upon the London County Council with respect to the supply of water." The Bill was issued last Wednesday morning, in view of the second reading, fixed for that day, but deferred. It is a very short measure; consisting simply of the preamble and three clauses, preceded by a memorandum.

The memorandum states that the London County Council, as successors of the Metropolitan Board of Works, have authority, under section 144 of the Metropolis Management Act, 1855, to introduce Bills for various purposes; but that it is doubtful if such Bills can be introduced unless they also include a power to make some "work for the improvement of the Metropolis." The object of the Bill now promoted is to remove this doubt, and to enable the Council in the future to introduce Bills dealing with the regulation of the existing supply or the purchase of works. This object is set out, in the usual phraseology, in the preamble of the Bill; and, if passed, the measure will be cited as the London Council (Water Supply) Act, 1891.

By the second clause, the powers conferred by the above-named section of the Metropolis Management Act are extended, and the Council are enabled from time to time to "prepare for and make any applications to Parliament with respect to the supply of water in or near the Metropolis, or with respect to the Companies authorized to provide such supply, and the undertakings of such Companies or any of them, and may institute and carry on inquiries and negotiations relating to such supply or to such Companies or to the acquisition of the undertakings of any such Companies, or any part or parts thereof, and may defray the expenses thereby incurred out of the county fund." It is provided "that no expense in relation to the promotion of any Bill under the powers of this section shall be defrayed in the manner aforesaid (except such costs and expenses as may be involved in the preparation for and settlement of such Bill), unless incurred in pursuance of a resolution of an absolute majority of the whole number of the Council at a meeting of the Council held after ten clear days' notice of such meeting, and of the purpose thereof, given to each member of the Council, in addition to the ordinary notice for summoning such meeting." The clause also contains a provision that "after the first reading of such Bill, no further expense shall be charged as aforesaid unless the propriety of promoting the same shall have been or shall be confirmed by a resolution of an absolute majority of the whole number of the Council at a further meeting to be held in pursuance of similar notices not less than fourteen days after the deposit of the Bill in Parliament."

The third clause provides that the expenses incurred in obtaining the Act are to be paid by the Council.

**Droitwich Water Supply.**—The Droitwich Town Council have for some time past been spending money in attempts to obtain an increased supply of water, but with no satisfactory result. The Streets and Sanitary Committee at a meeting of the Council last week reported that they had no alternative therefore but to recommend that notice be forthwith given to the East Worcestershire Water-Works Company for a supply of water under the provisions of that Company's Act. The Corporation would have to take from the Company a daily supply of 50,000 gallons, at a cost of 7d. per 1000 gallons; their present daily supply being 32,000 gallons. The matter was fully discussed; and the recommendation was adopted by nine votes to five.

## NOTES FROM SCOTLAND.

**From our Edinburgh Correspondent.**

EDINBURGH, *Saturday*.

The Aberdeen Town Council on Monday decided, by a majority of one on a division, to adopt the recommendation of the Gas Committee, which I gave last week—to contract for 36,000 tons of coal at an average price of 22s. per ton, the gas produced from which will be of 24·53-candle power. The other alternative proposals, as I mentioned last week, were to purchase 31,000 tons at 27s. per ton, to produce 27·60-candle gas; 35,000 tons at 23s. 1d. per ton, to produce 25·28-candle gas; or 41,000 tons at 18s. 8d. per ton, to produce gas of 22·60-candle power. The Convener of the Gas Committee (Bailie M'Kenzie), was in favour of the proposal which would have furnished gas of 25·28 candles; but his proposal was rejected by the Committee, in favour of the 24·53-candle scheme. This position required him to move the Committee's recommendation in the Council, although it was not his proposal; and he did so with the remark that he could not be expected to say much in favour of the report, seeing he objected to the whole thing. Mr. Findlay, who had moved the lower quality of gas in the Committee, seconded; and stated his belief that the lower quality of gas would give the greatest satisfaction to the largest number of the comsumers. He backed up his position with a remark which the late Dr. Wallace had made, to the effect that gas of 24·25-candle power would be the best for Aberdeen. Thereafter the malcontents had their innings, the burden of whose complaint was that the gas had been "of the most wretched description imaginable," and that it would not do to lower the quality, no matter what the price might be. The gas had not been, it was said, what "Aberdeen people had been accustomed to burn;" and again, "in the west-end, at the present time, where two burners previously lighted a room, six burners were now being used, and were not giving anything near the same light." One Magistrate suggested that they should take the 25-28-candle scheme, and purchase about 3000 tons of Cairntable coal, from which gas of 30-candle power could be produced, to mix with it; but this proposal was effectually extinguished by Bailie M'Kenzie, who said that in that event the illuminating power would only be increased by 0·41 candle, and the price would require to be raised 10d. per 1000 cubic feet. It was also stated that though the increase in the price of gas which was proposed was 4½d., the working of the new stoking machinery might reduce the increase to 3d. per 1000 feet. The contracts the Council have entered into are for the year ending Sept. 30; and it was not, consequently, necessary in the meantime to alter the price of gas.

The Elgin Gas Commissioners have resolved to introduce Mr. G. R. Hislop's system of regenerative retort-settings into their gas-works. The cost is calculated at £930, as compared with an estimated outlay of £735 upon the old system of settings.

At the Edinburgh and District Water Trust monthly meeting this week, Bailie Archibald stated, with reference to the proposed new water supply, that the reporting Engineers, Messrs. Hill, Gale, and Mansergh, had been in Edinburgh since the previous meeting of the Trust, and had visited the different districts, which were selected for experiments. He understood that very probably in the course of a few weeks, perhaps less, the Trustees would receive from the Engineers a report confined to the first branch of the remit—viz., the capabilities of the present works for supplying water; the consumption of water for domestic, shipping, and trade purposes; and whether it was desirable to proceed to take steps to procure a further supply. The Trustees adopted a proposal by Bailie M'Lachlan, that the Works Committee consider whether they should not visit the great water-works at Manchester, Liverpool, and other places before going on with the new scheme. The Finance Committee reported that of £83,958 of mortgages which fell due at Whitsunday, £19,600 had been renewed for seven years at 3½ per cent.; and that of the remainder, £55,350 had been reborrowed, also for seven years, at 3¼ per cent. This left £9008 to be paid out of the sinking fund, which is a very substantial reduction of the indebtedness of the Trust.

**From our Glasgow Correspondent.**

GLASGOW, *Saturday*.

The most important event in connection with the gas industry in Scotland this week has been the informal meeting of gas managers which was held in this city yesterday. It was the most successful gathering of the kind held since the decease of the West of Scotland Association of Gas Managers. On the same day a meeting of the Committee of the North British Association was held, and this circumstance materially contributed to secure a good attendance of persons holding prominent positions in the gas industry north of the Tweed. Then, again, there was a general desire to reciprocate the compliment paid to the Scotch managers by Mr. Hepworth, who attended from the Border City of Carlisle, as President of The Gas Institute, to show personally his desire to cultivate a friendly feeling with gasmen farther north than himself, and to encourage them to strengthen his hands and those of the other members of the governing body of the Institute by becoming members of it. It was remarked, in the course of the day, that there were only some 25 or 30 members of the Institute in Scotland; but I have good reason to know this number will be materially increased at the forthcoming meeting. A considerable number of candidates for membership have signed the application form, chiefly through the active canvassing of one of the Scotch members. It is not at all unlikely, therefore, that the Carlisle meeting of the Institute will be largely attended from this side of the Solway and the Tweed. One of the points of peculiar interest to gas managers which the Chairman gave place to, and which Mr. M'Gilchrist very specially accentuated, was the disaster to the Dawsholm gasholders. The gentleman last named was very decided in scouting the idea that dynamite had anything to do with the first holder giving way. He was very guarded in what he said as to the primary cause of the disaster being known; but he left no room for doubt that either he or some other person was well aware what it was. If that be so, it seems to me to be highly proper that the matter should be re-opened in order that he may, as a responsible expert, state what he actually knows as to the *vera causa*. I have myself this afternoon been in conversation with a civil engineer of keen observing powers, who told me that he was a witness of the immense atmospheric fire that was due to the ignition of the escaping gas. There was nothing between him and the Dawsholm works at the time, to prevent him and his companion from hearing the report of any explosion that might and would have happened if dynamite had been fired on the top of No. 2 holder, but no report was heard by either of them; and the time of the occurrence was most carefully registered Returning, however, to what Mr. M'Gilchrist has publicly stated, it will clearly be very culpable on the part of the proper authorities if they allow the matter to remain where he has left it. I have not exchanged words with him on the subject in question; and consequently what the extent of his information or its exact nature may be is quite unknown to me. But having had something to do with the preliminary negotiations that ultimately led to the only dynamite manufactory in the United Kingdom being established in Scotland, I naturally feel a certain amount of personal interest in the matter; and it is just possible that Mr. M'Gilchrist may have some regard for the fair fame of the county (Dumbarton) in which he resides, and in which the Dawsholm works are situated. The £1000 reward for the discovery and conviction of the supposed "dynamiter" has been issued through the Police authorities of that county; and possibly the Dumbarton Gas Manager may have heard some more or less suggestive or ominous hints thrown out by the County Police Superintendent.

Another event of interest to the gas industry is the opening of a gas-stove exhibition of very considerable extent, and a series of cookery lectures and demonstrations in connection therewith, under the auspices of the Kilmarnock Corporation Gas Committee. The exhibitors are Messrs. R. and A. Main, Messrs. H. Darwin and Co., the Carron Company, and Messrs. John Wright and Co. Amongst them they have "installed" about 200 gas-cookers, gas-fires, and other gas-heating appliances. The exhibition was opened in the Corporation Art Gallery on Tuesday; the chair being taken (in the absence of Provost M'Lelland) by ex-Bailie Brown, Convener of the Gas Committee. He was well supported by his colleagues generally; and there was a very large attendance of ladies. Mrs. Thwaites, of Liverpool, who lately did a week's lecturing for Messrs. Darwin and Co. in the Glasgow East-End Exhibition, is the lady demonstrator engaged for the Kilmarnock show. In the course of an interesting address in opening the proceedings, Mr. Brown stated that there were already something like fifty heating and cooking stoves in use in Kilmarnock, which consumed, it was estimated, half-a-million cubic feet of gas per annum. If they could get into use, say, 600 fires and stoves, they would consume about three million feet of gas per annum, giving a yearly revenue of £450. He was satisfied that the use of gas as a fuel was on the increase, not only for cooking, but also for engine purposes; and the more gas they could manufacture, the lower the price they would be able to charge for it. He also stated that the gas-works of the town were taken over by the Corporation in 1872, at a cost of £44,000; and that they had gradually been reducing the indebtedness of the Town Council till now it was only £24,000. In 1872 the gas manufactured was at the rate of 29 million feet per annum, and last year they made some 68 millions; while their plant was now capable of producing 90 million feet per annum. Hence their desire to get a new outlet for the consumption of gas. Last night the number of persons desiring admission to the lecture hall at the exhibition was so large that they could not all be accommodated; and Mrs. Thwaites agreed to repeat the lecture and demonstration (which dealt with a full dinner course) on Monday evening.

As to the "leaps and bounds" referred to in last week's "Notes," in respect of the increasing consumption of gas from the Glasgow gas-works, I am able to state that the revenue reported from gas-rents for the current year up till last Wednesday was upwards of £28,600 more than that collected at the corresponding date of the past year. Of course, there is a much bigger outlay this year than in the last financial year. For example, a fortnight's wages bill now is quite £1500 larger than a similar bill at the corresponding time in 1890.

The Glasgow Corporation Special Committee on Electric Lighting have made a little more progress towards putting their Provisional Order into operation. They have resolved to take Sir William Thomson into their confidence, to advise them professionally as to whether they should adopt a high-tension or a low-tension current over the compulsory lighting area which is scheduled in the Order.

In the earlier part of this week the Glasgow pig-iron market was dull, and without much alteration in the prices of warrants; but on Thursday and Friday it firmed up considerably, on large buying orders becoming known. There is no new feature to report regarding the position of the trade generally. Scotch warrants opened at 42s. 6d. per ton cash, and declined to 42s. 1¼d.; and the close yesterday was 43s. 1¼d. cash, or an improvement of 1s. per ton from the lowest point. The improvement in the price of hematite iron from the lowest was 1s. 1d. per ton, to 47s. 7d.; and in the case of Cleveland iron 9d. per ton, to 38s. 6d. The number of furnaces in blast is still 41.

The coal trade does not improve at all; and this week values have declined in most cases 3d. per ton. Main coal is quoted at 7s. 6d. per ton f.o.b.—the lowest level reached for a year. Steam coal maintains its price fairly well.

**The Improvement of the Worcester Water-Works.**—The members of the Worcester Town Council had under consideration last Tuesday a report by the Water and Sewerage Committee on the question of improving the water-works. They stated that the water supplied to the city was well filtered and clear, and except in case of flood or great turbidity of the Severn, was delivered in good condition. The Surveyor had prepared plans showing an additional subsiding tank to contain about 800,000 gallons, and a filter-bed. If a large reserve reservoir was considered desirable, it might be constructed on land belonging to the Corporation about half a mile north of the water-works; and if this were made, more filters might be substituted for the proposed subsiding tank. An alternative proposal was that a part of the Barbourne Park Estate should be used for an open storeage reservoir. After some discussion, the further consideration of the report was adjourned.

## CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 11.

**Sulphate of Ammonia.**—The market has been very steady during the greater part of the week; but latterly some irregularity in the prices is perceptible. Hull and Leith quotations have been pretty firm at £11 2s. 6d.; and the quantities available are by no means large. The west-coast ports seem to occupy a somewhat different position in respect to figures, which may be said to be due to the heavy shipments to America. For instance, as much as £11 11s. 3d. is reported to have been paid at Glasgow, and £11 7s. 6d. at Liverpool. At the latter port, however, sulphate is now offering at £11 to £11 2s. 6d. for April and May delivery, notwithstanding the fact that shipments far exceeding present production—viz., about 800 tons—have been sent off since the beginning of the month. The nitrate market has a firmer tone; there being a change in the position through the disposal of the greater part of the cargoes at port of call, and the condition of affairs on the west coast making the outlook as regards future supplies precarious.

LONDON, *April* 11.

**Tar Products.**—There has been dulness in this market during the whole of the week; and business only of a minor character is reported. The price of pitch is quoted firmer; but there are sellers at less than the quotation below. Benzols are still neglected; and solvent naphtha is also difficult to sell. There is a better demand for carbolic acid; and makers are more hopeful than they have been for twelve months. "A" quality anthracene is in moderate demand; but "B" is not ready of sale. The prospect for tar products is not so hopeful; and the effect is seen in the lower prices now being paid for tar—one contract of some size having been recently let at 28s. Prices current are: Pitch, 34s. 6d. London; 32s. 6d. country. Benzol, 90 per cent., 4s. 3d.; 50 per cent., 3s. 1½d. Toluol, 1s. 9d. Solvent naphtha, 1s. 7½d. Crude naphtha, 1s. 6d. Creosote, 1⅜d. Carbolic, 35 crystals, 5½d.; crude, 60's, 1s. 5½d. Cresol, 10d. Anthracene, "A" quality (30 per cent.), 1s. 4d.; "B" quality, 1s.

**Sulphate of Ammonia.**—The "bears" seem to keep possession of this market; and although this is the season of all others when sulphate should be in demand, and easily disposed of, unfortunately it is neglected, and buyers all speak of lower prices. Stocks are low; and whatever reports are to the contrary, the actual demand is as great as ever, and there is no reason why makers should lend themselves to the machinations of "operators." Business has been reported at £11 to £11 6s. 3d.; and ammoniacal liquor, at 5s. 6d. to 7s.

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**A Water Supply Scheme Wanted for Kustendji.**—The Municipality of Kustendji, in Bulgaria, are offering a prize of 12,000 frs. for the best scheme of water supply for the town.

**Electric Lighting for Leeds.**—The Parliamentary Committee of the Leeds Corporation last Friday resolved to recommend the Council to support the application of the House-to-House Electric Lighting Company for a Provisional Order empowering them to supply electricity in the borough.

**A Natural Water Reservoir in the Sahara.**—According to a telegram received through Reuter's agency, a large body of water has been discovered at El Golea, in the Desert of Sahara, about 120 feet below the surface. It throws up nearly 40 gallons a minute at present; and it is anticipated that the yield will be much greater when more perfect access to the water is attained. The discovery is regarded as of high importance; this being the first time that water has been found in the Sahara at so small a depth.

**A New Reservoir for the Kent Water Company.**—Last Wednesday afternoon, Mr. Smith, Chairman of the Kent Water-Works Company, formally opened a new reservoir adjoining Eltham Park. It is 220 feet above the level of the sea, and it stands on 1¼ acres of land. Its diameter is 203 feet; its circumference 602 feet; and its depth, 16 feet—its capacity being 3 million gallons. The walls are of concrete (in some places 6 feet thick), and lined with brickwork. The inner circular walls, which support the roof, form channels along which the water will flow four times round the reservoir, and then pass out at the centre. The water will be brought to the reservoir from the pumping-station at Wilmington, about eight miles distant, through a 24-inch main; and it will be carried by gravitation in a similar main to Lewisham, where it will be distributed through the existing pipes in aid of the supply of the Metropolitan district. After the reservoir had been declared open, the assembled company inspected the interior, and saw the water turned on.

**Adoption of the Oxygen Process of Purification at Dukinfield.**—In the JOURNAL for the 10th ult. it was stated that the Gas Committee of the Dukinfield Local Board had under consideration a report by the Gas Engineer (Mr. Harrison Veevers) dealing with the existing purifying arrangements, which are very inadequate, and recommending the adoption of the Brin oxygen process. At the meeting of the Committee on the 1st inst., the recommendation was agreed to, and Mr. Veevers was instructed to procure tenders for four purifiers, with the necessary valves and connections, according to his plans and specifications, and submit them to the Committee at a special meeting to be held yesterday. On the Committee's minutes coming before the Board at their meeting on Monday last week, the Chairman (Mr. Taylor) stated that, by adopting the process suggested, there would be a saving of something like £2000. After perusing the report presented by Mr. Veevers, and considering his statements as to the economy that would result from the new system of purification, the Committee had no hesitation in assenting to his proposals, more especially as improvements previously recommended by him had not only proved highly successful, but had sometimes surpassed his expectations. Mr. Veevers's report (an abstract of which has already appeared) was read; and it was explained that it was a question of laying out either £600 for six purifiers on the present plan, or £4400 for four on the oxygen system; and the Committee had decided to spend the latter amount, which they thought would be best. But apart from the difference in first cost, there would be a net annual saving of £145 by the disuse of cannel. After some conversation, the minutes were confirmed.

**The Rickmansworth and Uxbridge Valley Water Company's Capital** is to be increased by the issue of the remainder (1380) of the £10 shares.

**A New Water Supply for Lurgan.**—The Lurgan Board of Commissioners have agreed to make formal application to the Local Government Board for sanction to borrow £20,000 for the purpose of providing the town with a supply of water from Lough Neagh.

**Lancashire Coal Trade.**—The demand for most descriptions of coal continues steady; and the improvement noticed last week is fully maintained. Prices, however, do not show any quotable change; and generally they may be repeated. Business in steam coal for the shipping trade is quiet; the price ranging from 10s. 3d. to 10s. 6d. per ton delivered at the ports on the Mersey.

**Extensions at the Torquay Gas-Works.**—The Directors of the Torquay Gas Company have recently decided on carrying out considerable extensions of their works, including a new 80-feet telescopic gasholder, retort-benches, and steel foul mains, according to the designs of their Engineer (Mr. R. W. Beynon). The whole of the work has been entrusted to Messrs. Willey and Co., of Exeter.

**The Main Drainage of London.**—At the meeting of the County Council last Tuesday, a recommendation by the Main Drainage Committee, that detailed plans should be prepared of the new sewers on both sides of the river, as proposed by Sir Benjamin Baker and the Chief Engineer of the Council (Mr. A. R. Binnie, M. Inst. C.E.), in the joint report lately presented by them on the main drainage of London, was adopted.

**Lecture on Gas and Gas Lighting at Carlisle.**—A lecture entitled "A Gas-Jet" was delivered on Monday evening last week, to the Carlisle Scientific Society, by Mr. John Holliday. It was illustrated by experiments showing the chemical properties of the different gases constituting a gas-flame, and their functions; also the physical structure of flames. The best conditions for developing the illuminating power of coal gas were also touched upon; and, in illustration of this part of the lecture, Mr. Holliday pointed out the advantages possessed by the latest forms of regenerative burners (of which three kinds had been fitted up in the room) over the ordinary flat-flame and Argand burners. Mr. Hepworth was present, and seconded a vote of thanks to the lecturer, which was heartily accorded.

**Conviction of a Stoker for Leaving His Work without Permission.**—At the Widnes Petty Sessions last Thursday, John Callaghan appeared in answer to a charge of having broken his contract with the Widnes Local Board, by leaving his work without permission. Defendant and a man named Cooke threw up their work on the evening of Sunday, the 1st ult., at about six o'clock in the evening; though both of them had, with the other men, been cautioned against neglecting their duties. Cooke, it may be remembered (see *ante*, p. 513), was summoned for his offence, and fined 40s. and costs. But Callaghan absconded; and a warrant had to be issued for his apprehension. He afterwards returned to Widnes, and gave himself up to the police. He now pleaded "guilty," and expressed sorrow for what he had done; stating that if he had thought it was such a serious thing, he would not have left his work. He was nevertheless fined 40s., or one month's imprisonment in default of payment.

**The Birmingham Gas Department and the Railway Rates for the Carriage of Coal.**—Last Wednesday, a public meeting, convened by the Birmingham and District Railway and Canal Freighters' Association, with the object of arranging for the defence of local trading interests before the Joint Parliamentary Committee on Railway Rates, was held in Birmingham under the presidency of Mr. Joseph Chamberlain, M.P. In the course of the proceedings, the Chairman of the Gas Committee (Mr. Alderman Pollack) stated that the railway companies had been accustomed to allow a rebate on coal brought to Birmingham for gas-making purposes. Now they said that, in consequence of the Act, they were unable to charge preferential rates, and they refused the rebate. The result was that the gas consumers of Birmingham had been fined £11,000, or equal to nearly 1d. per 1000 cubic feet. Mr. Chamberlain said he was inclined to make one practical suggestion arising out of these remarks. Alderman Pollack had told them that the Gas Department was prejudiced by these rates to the extent of £11,000 per annum. This was a very serious thing for the community, who were all interested in the success of the gas undertaking; and it appeared to him to be the clear duty of the Gas Committee of the Town Council to protect the interests of its citizens by protesting in the most effective way against the continuance of this imposition.

**Hinckley Local Board Gas Supply.**—At the meeting of the Hinckley Local Board last Tuesday, the Gas Manager (Mr. E. H. Millard) reported that the make of gas for the year ending the 25th ult. was 30,459,300 cubic feet; being an increase of 4,290,000 cubic feet, or equal to 16·39 per cent. During the year 193 new meters were fixed and 67 removed; leaving a net gain of 126 consumers, compared with a gain of 35 in the previous year—an abnormally large gain. He stated that the profit, after paying interest and redemption, might probably reach £500 (notwithstanding an increase to this extent in the price of coal), out of which £200 would be added to the balance left last year to pay for the sulphate plant. He made this announcement (which might appear somewhat premature) in order that the Board might take into consideration a suggestion to popularize the use of gas for other than lighting purposes by holding a gas exhibition, and announcing a reduction in the price for the two summer quarters of 5d. per 1000 feet. This would result in a reduction of revenue on last year's consumption of £137 10s.; but he anticipated the increased consumption would recoup this, as it only required an increase of 20 per cent., one-half of which he considered assured from the large number of consumers added during the last few months. He further suggested that a suitable gas cooker be selected to hire out at 1d. per week among the weekly consumers, who would also benefit by a reduction in the price from 4½d. to 4d. per 100 cubic feet. The reduction would also benefit the users of gas-engines. The question of a reduction in the price for the winter quarters could, he thought, be deferred until the books had been properly balanced, and the new coal and coke contracts entered into. The report was referred to the Gas Committee.

**Deacon's Waste-Water Meters at Skipton.**—The Skipton Local Board last Thursday resolved to have five of Deacon's waste-water meters placed in different parts of the town, at a cost of £250. It is anticipated that by means of the meters the necessity of temporarily augmenting the present supply of water will be obviated.

**Explosion Caused by Natural Gas.**—According to a telegram from the New York Correspondent of the *Western Morning News*, a serious disaster occurred at Braddock last Tuesday. In that town the natural gas of the locality is utilized largely for lighting purposes. Something went wrong with the piping of a tenement house, and the consequence was a terrible explosion. Eleven occupants of the building, all Hungarians, were severely burned; and four at least are not expected to recover.

**The Gaslight and Coke Company's Cookery Lectures.**—The Gaslight and Coke Company commenced the present season's cookery lectures at the Holborn Town Hall on Tuesday last, when Miss Edden gave practical demonstrations for four consecutive days; the attendance on all occasions being very good. The cooking-stoves used were changed daily, and were the manufacture of Messrs. T. Fletcher and Co., Messrs. R. and A. Main, Messrs. William Sugg and Co., and Messrs. J. Wright and Co., Limited. Along one side of the hall the appliances of the various makers were arranged, so that the public could select stoves without being biassed by any maker. There was an attractive collection of other exhibits, including asbestos fuel, by Messrs. Pardoe and Sons, of Kilburn; hot water geysers, by Messrs. Ewart and Son, of the Euston Road; gas-regulators, by Messrs. Slatter and Watkins; and a miscellaneous assortment of general goods by Messrs. Fletcher and Co. and Messrs. Wright and Co.

**Proposed Water Company for Slaithwaite.**—A few months ago it was rumoured that the Huddersfield Corporation were negotiating for the purchase of the water-works, owned by Lord Dartmouth, by which Slaithwaite is supplied with water. This announcement caused some commotion among the inhabitants of the district, because it was felt that, if the supply fell into the hands of the Corporation, there would be an increase in the price charged to the consumers. A letter pointing this out was addressed to Lord Dartmouth's agent in London (Mr. Flynne); and he replied to the effect that his Lordship would be willing to transfer the works to the ratepayers of Slaithwaite. A few days ago a public meeting was held in the town, at which the matter was discussed; and a resolution was passed, declaring that it was desirable to form a Company to acquire the property. A Committee was also appointed to make further inquiries.

**Northern Coal Trade.**—The coal trade is very firm in the North of England, and both steam and gas coals are rather higher in price. Best Northumbrian steam coal is very firm at 12s. per ton, free on board, and the demand is strong—most of the collieries having very full turns on. Second-class coal stands at about 11s. per ton lower than best; and small steam is steady at 5s. per ton. For gas coal there is a better inquiry; and some contracts have been made which will take up a considerable part of the output of the collieries. One of these is for the supply of Lisbon; and the accepted tender is about 15s. 4d. at that port. Taking current rates of freight, this would leave a little more than 9s. as the price for the coal here. From this figure up to 10s. is the usual rate asked for uncontracted coal, according to quantity and quality needed. The contract for The Gaslight and Coke Company's supply is now in the market; and it will provoke some interest before its settlement. As the shipping season to the Baltic is now beginning, a large quantity of coal will be sent there; and this fact and the possibility of a strike at the Belgian collieries, is expected to stiffen the coal markets. Bunker coals are very dull; but there is a better demand for smithy coal at a high price. Coke for blast-furnaces is firm at from 17s. to 18s. per ton, free on board; and large shipments are anticipated. Gas coke is unaltered in price; but the production is rather less.

## GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 686.)

| Issue. | Share | When ex-Dividend. | Dividend or Div. & Bonus. | NAME. | Paid per Share. | Closing Prices. | Rise or Fall in Wk. | Yield upon Investment. |
|---|---|---|---|---|---|---|---|---|
| £ | | | p. c. | GAS COMPANIES. | | | | £ s. d |
| 590,000 | 10 | 10 Apl. | 10½ | Alliance & Dublin 10 p. c. | 10 | 16—17* | .. | 6 3 6 |
| 100,000 | 10 | „ | 7½ | Do. 7 p.c | 10 | 11½—12½* | −½ | 6 0 0 |
| 300,000 | 100 | 2 Jan. | 5 | Australian (Sydney) 5 % Deb. | 100 | 106—108 | .. | 4 12 7 |
| 100,000 | 20 | 27 Nov. | 8 | Bahia, Limited | 20 | 13—15 | −1 | 10 13 4 |
| 200,000 | 5 | 13 Nov. | 7½ | Bombay, Limited | 5 | 6¾—7¼ | .. | 5 3 5 |
| 40,000 | 5 | „ | 7½ | Do. New | 4 | 5—5⅛ | .. | 5 9 1 |
| 380,000 | Stck. | 26 Feb. | 12½ | Brentford Consolidated | 100 | 212—217 | .. | 5 12 10 |
| 125,000 | „ | „ | 9½ | Do. New | 100 | 155—160 | .. | 5 15 7 |
| 220,000 | 20 | 12 Mar | 11½ | Brighton & Hove Original | 20 | 40—42 | .. | 5 9 6 |
| 320,000 | 20 | 10 Apl. | 11½ | British | 20 | 43—45* | .. | 5 0 0 |
| 50,000 | 10 | 12 Mar. | 11 | Bromley, Ordinary 10 p. c. | 10 | 18—20 | .. | 5 10 0 |
| 39,000 | 10 | „ | 8 | Do. 7 p. c. | 10 | 13—15 | .. | 5 6 8 |
| 328,750 | 10 | 13 Nov. | 6 | Buenos Ayres (New) Limited | 10 | 10—11 | .. | 5 9 1 |
| 200,000 | 100 | 2 Jan. | 6 | Do. 6 p. c. Deb. | 100 | 100—103 | .. | 5 16 7 |
| 150,000 | 20 | 26 Feb. | 8 | Cagliari, Limited | 20 | 25—27 | .. | 5 18 6 |
| 550,000 | Stck. | 10 Apl. | 13½ | Commercial, Old Stock | 100 | 255-260* | +4½ | 5 5 9 |
| 130,000 | „ | „ | 10½ | Do. New do. | 100 | 194-199* | +1½ | 5 8 0 |
| 130,000 | „ | 30 Dec. | 4½ | Do. 4½ p. c. Deb. do. | 100 | 121—126 | .. | 3 11 5 |
| 557,320 | 20 | 30 Dec. | 13 | Continental Union, Limited | 20 | 48½—49½ | .. | 5 5 0 |
| 242,680 | 20 | „ | 13 | Do. New '69 & '72 | 14 | 33—34 | .. | 5 7 0 |
| 200,000 | 20 | „ | 10 | Do. 7 p. c. Perf. | 20 | 37—39 | .. | 5 2 6 |
| 75,000 | Stck. | 25 Mar. | 10 | Crystal Palace District | 100 | 195—205 | .. | 4 17 7 |
| 486,090 | 10 | 28 Jan. | 4† | European, Limited | 10 | 19½—20½ | .. | — |
| 354,660 | 10 | „ | 4† | Do. Partly paid | 7½ | 14—15 | .. | — |
| 5,470,630 | Stck. | 12 Feb. | 13 | Gaslight & Coke, A, Ordinary | 100 | 240—244 | +1 | 5 6 6 |
| 100,000 | „ | „ | 4 | Do. B, 4 p. c. max. | 100 | 96—99 | .. | 4 0 10 |
| 665,000 | „ | „ | 10 | Do. C, D, & E, 10 p.c. Pf. | 100 | 252—257 | +1 | 3 17 9 |
| 30,000 | „ | „ | 5 | Do. F, 5 p. c. Prf. | 100 | 118—123 | .. | 4 1 3 |
| 60,000 | „ | „ | 7½ | Do. G, 7½ p. c. do. | 100 | 174—179 | .. | 4 3 9 |
| 1,300,000 | „ | „ | 7 | Do. H, 7 p. c. max. | 100 | 160—165 | −1 | 4 5 4 |
| 463,000 | „ | „ | 10 | Do. I, 10 p. c. Prf. | 100 | 250—255 | +2 | 3 18 5 |
| 476,000 | „ | „ | — | Do. K, 6 p. c. Prf. | 100 | 148—153 | .. | 3 18 5 |
| 1,061,150 | „ | 12 Dec. | 4 | Do. 4 p. c. Deb. Stk. | 100 | 113—118 | .. | 3 7 10 |
| 294,850 | „ | „ | 4½ | Do. 4½ p. c. do. | 100 | 122—126 | .. | 3 11 5 |
| 908,000 | „ | „ | 6 | Do. 6 p. c. do | 100 | 165—170 | .. | 3 10 6 |
| 3,800,000 | Stck. | 13 Nov. | 12 | Imperial Continental | 100 | 231—236 | +1 | 5 1 8 |
| 75,000 | 5 | 12 Dec. | 6 | Malta & Mediterranean, Ltd. | 5 | 5—5⅛ | .. | 5 9 1 |
| 560,000 | 100 | 1 Apl. | 8 | Met. of Melbourne, 5 p. c. Deb. | 100 | 110—112 | .. | 4 9 3 |
| 541,920 | 20 | 27 Nov. | 7½ | Monte Video, Limited | 20 | 18¼—19¼ | +½ | 6 13 4 |
| 150,000 | 5 | 27 Nov | 10 | Oriental, Limited | 5 | 8¾—9¼ | .. | 5 8 1 |
| 60,000 | 5 | 25 Mar. | 7 | Ottoman, Limited | 5 | 4—5 | −½ | 7 0 0 |
| 166,870 | 10 | 26 Feb. | 2 | Pará Limited | 10 | 3¾—4¼ | .. | — |
| 420,000 | 100 | 3 Nov. | 6 | People's Gas of Chicago— 1st Mtg. Bds. | 100 | 95—100 | .. | 6 0 0 |
| 500,000 | 100 | 1 Dec. | 16 | 2nd Do. | 100 | 93—98 | .. | 6 2 5 |
| 150,000 | 10 | 10 Oct. | 10 | San Paulo, Limited | 10 | 16—17 | .. | 5 17 8 |
| 500,000 | Stck. | 26 Feb. | 15½ | South Metropolitan, A Stock | 100 | 282—287 | +2 | 5 8 0 |
| 1,350,000 | „ | „ | 12 | Do. B do. | 100 | 235—240 | .. | 5 0 0 |
| 166,500 | „ | „ | 13 | Do. C do. | 100 | 240—250 | +2½ | 5 4 0 |
| 678,000 | „ | 30 Dec. | 5 | Do. 5 p. c. Deb. Stk. | 100 | 140—145 | .. | 3 9 0 |
| 60,000 | 5 | 12 Mar. | 11½ | Tottenham & Edm'nton, Orig. | 5 | 11—13 | .. | 4 8 5 |
| | | | | WATER COMPANIES. | | | | |
| 729,221 | Stck. | 30 Dec. | 10 | Chelsea, Ordinary | 100 | 260—270 | −5½ | 3 14 1 |
| 1,720,560 | Stck. | 10 Apl. | 8 | East London, Ordinary | 100 | 210—215* | −1½ | 3 14 5 |
| 544,440 | „ | 30 Dec. | 4½ | Do. 4½ p. c. Deb. Stk. | 100 | 140—145 | .. | 3 2 0 |
| 700,000 | 50 | 12 Dec. | 9 | Grand Junction | 50 | 116—122 | −2 | 3 14 5 |
| 708,000 | Stck. | 12 Feb. | 10½ | Kent | 100 | 265—275 | −5 | 3 16 4 |
| 1,013,800 | 100 | 30 Dec. | 9½ | Lambeth, 10 p. c. max. | 100 | 248—253 | −2 | 3 15 1 |
| 406,200 | 100 | „ | 7½ | Do. 7½ p. c. max. | 100 | 197—202 | .. | 3 14 3 |
| 260,000 | Stck. | 25 Mar. | 4 | Do. 4 p. c. Deb. Stk. | 100 | 118—123 | .. | 3 5 0 |
| 500,000 | 100 | 12 Feb. | 12½ | New River, New Shares | 100 | 355—360 | −2 | 3 7 4 |
| 1,000,000 | Stck. | 28 Jan. | 4 | Do. 4 p. c. Deb. Stk | 100 | 125—128 | .. | 3 2 6 |
| 902,300 | Stck. | 12 Dec. | 7 | S'thwk & V'xhall, 10 p. c. max. | 100 | 170—180 | −2½ | 3 17 9 |
| 126,500 | 100 | „ | 7 | Do. 7½ p. c. do. | 100 | 165—170 | −3 | 4 2 4 |
| 1,135,066 | Stck | 12 Dec. | 10 | West Middlesex. | 100 | 255—265 | −2½ | 3 13 6 |

*Ex div.

† Interim dividend.


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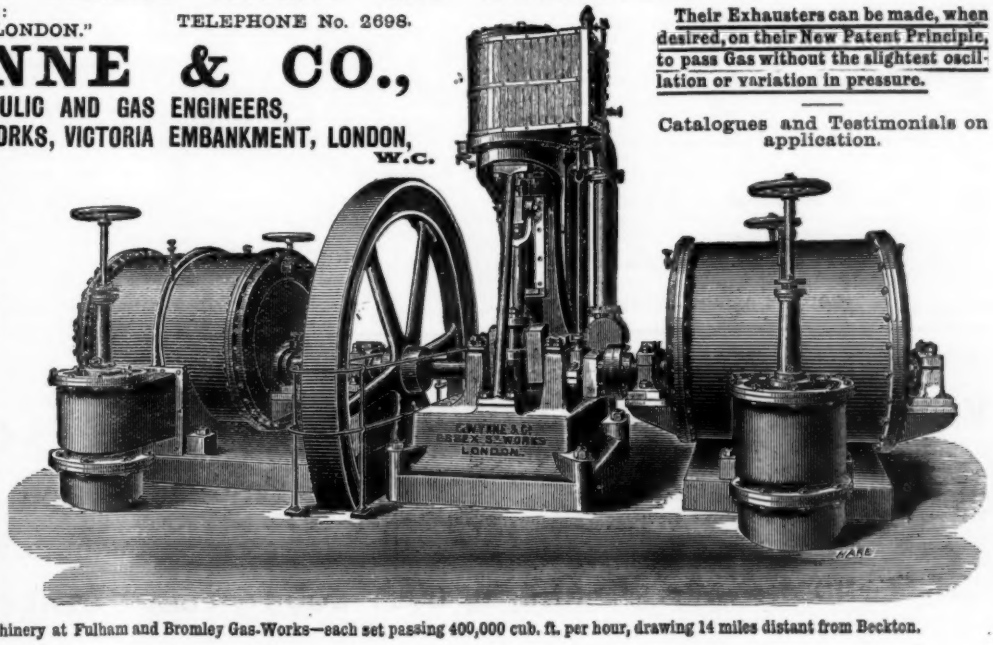


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*** See Advertisement p. 722 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

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**WANTED, a Working Foreman,** thoroughly experienced in Gas Making, and capable of taking charge and management of the Burgess Hill Gas-Works, laying and testing Mains, fixing Retorts, taking Meters, &c. Salary 35s. a week, with good House and Garden, and Coal and Gas free.
Apply, stating age, with testimonials (two), on or before the 24th inst., to the SECRETARY, Gas Company, Burgess Hill, SUSSEX.

**WANTED, at a Gas-Works, a trust-** worthy and energetic MAN to keep the Books. Preference given to a man who is now in a similar position, and one well acquainted with the general routine work of a Gas-Works. Wages to commence with 25s. per week.
Apply, by letter, stating age, with not more than three recent testimonials, to No. 1933, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**FOR SALE, very cheap—A second-hand** patent ROTARY WASHER, in good condition. Capacity, quarter of a million per diem. Also a STATION GOVERNOR of the same capacity.
For price, &c., either as they stand, or overhauled and put in good working order, apply, by letter, to No. 1937, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**FOR SALE—Two Purifiers, 10 feet. by** 8 feet; one PURIFIER, 8 ft. by 6 ft. by 3 ft. 6 in. deep, with covers; 8-inch CENTRE-VALVE and CONNECTION, LIFTING APPARATUS, &c.; also one 6-inch GOVERNOR. All in good condition.
The above can be seen at the Market Harborough Gas-Works.
F. ARMITAGE, Engineer.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

**BALE, BAKER, & CO., direct Importers** from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.

SULPHURIC ACID.

**JOHN NICHOLSON & SONS, Chemical** Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

**JOHN RILEY & SONS, Chemical Manu-** facturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

**HUTCHINSON BROTHERS, Barnsley,** Gas Engineers and Contractors, Makers of Wet and Dry Gas-Meters and General Gas Apparatus, Sulphate of Ammonia Plant, Lead Saturators, Tanks, &c. Tools and Sundries.

BENTLEY & CO.

MANCHESTER ELECTRICAL STORES.

**FOR Batteries, Bells, Wires, and Special** Electrical Apparatus, address the best house
17, NEWTON STREET, PICCADILLY, MANCHESTER.

**ON SALE—Freehold Manufactory in** Birmingham, containing about 1600 square yards of land, about one-half of which is occupied by well-built Workshops, Engine, Boiler, and Stack. On a main road nearly central between two Railway Stations, and only a few minutes' walk from either. Price £3500.
Apply, by letter, to No. 1940, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

COAL CONTRACT.

**THE Gas Commissioners of the Burgh** of Dumfries will receive OFFERS for the supply of about 5000 tons of CANNEL COAL.
Delivery, as required by the Manager, between the 15th of May, 1891, and the 15th of May, 1892. Carriage paid to Dumfries Station.
Endorsed tenders to be lodged with John Grierson, Esq., Town Clerk, Dumfries, on or before the 18th urrent.
The Gas Commissioners will not bind themselves to accept the lowest or any tender.
Town Hall, Dumfries,
April 3, 1891.

TENDERS FOR GAS COAL.

**THE Corporation of Droitwich invite** TENDERS for the supply of about 1000 tons of best screened GAS COAL, at per ton of 21 cwt., to be delivered free at Droitwich (G. W.) Railway Station at such times and in such quantities as may be required.
The contract will be for one year, commencing on the 1st prox.
Tenders (with analysis of the Coal to be supplied), properly endorsed "Tender for Gas Coal," to be sent to the undersigned on or before the 24th inst.
The Corporation do not bind themselves to accept the lowest or any tender.
S. JOHN TOMBS, Town Clerk.
Droitwich, April 3, 1891.

BOROUGH OF WARRINGTON.

TENDERS FOR TAR.

**THE Gas Committee invite Tenders** for the purchase of TAR at their Works for One Two, or Three years; the weight being about 1200 tons.
Particulars and conditions of contract will be forwarded on application to the undersigned.
Tenders, endorsed "Tender for Tar," and addressed to the Chairman of the Gas Committee, to be sent in not later than the 16th inst.
The Committee do not bind themselves to accept the lowest or any tender.
FREDK. TAYLOR, Secretary.
Gas Offices, Warrington,
April 2, 1891.

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THE

# VALUATION OF GAS-WORKS FOR ASSESSMENT,

By THOMAS NEWBIGGING, M. Inst. C.E.,

With an Appendix containing a Statement of the most Important Cases bearing on the Question, and decided by the Superior Courts. Each of these is preceded by a Digest; and the Judgments are given in full.

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FOR

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BY

THOMAS NEWBIGGING, M. Inst. C.E.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

## WINCHESTER WATER AND GAS COMPANY.

TENDERS FOR COAL.

**THE Directors of the Winchester Water** and Gas Company invite TENDERS for the supply of good COAL suitable for gas making, and yielding, under ordinary working conditions, not less than 10,500 cubic feet per ton of 20 cwt., to be delivered in trucks at the Winchester Station, S.W.R., in such quantities (about 300 tons) from time to time as may be directed, commencing July, 1891.

Requirements: 5000 to 6000 tons per annum.

Tenders, giving full particulars of the description of coal offered, may be sent to me, endorsed "Tender for Coal," on or before the 28th inst.

The Directors do not bind themselves to accept the lowest or any tender.

W. UPTON TINNEY,
Manager.

April 11, 1891.

## FALMOUTH GAS COMPANY.

TO GAS APPARATUS MAKERS.

**THE Directors of the above Company** are prepared to receive TENDERS for the supply and erection of four new PURIFIERS, 12 feet square by 5 feet deep, with Centre-Valve and Connections; also for CAST-IRON COLUMNS and WROUGHT-IRON GIRDERS for carrying the Purifiers overhead.

Drawings and specifications may be seen at the Gas-Works, or tracing and copy of specification will be forwarded, on receipt of One Guinea, by the undersigned.

Tenders, marked "Purifiers, &c.," must be sent in not later than Monday, the 20th of April, 1891.

The Directors do not bind themselves to accept any tender.

JOSEPH WM. BUCKLEY,
Engineer and Manager.

Gas-Works, Falmouth, April 1, 1891.

## LIVERPOOL UNITED GASLIGHT COMPANY.

**THE Directors of the Liverpool United** Gaslight Company are prepared to receive TENDERS for the supply of 100,000 tons of CANNEL and 200,000 tons of COAL, to be delivered at the various Works of the Company, during the period of Twelve Months between the 1st of July, 1891, and the 30th of June, 1892.

Tenders will be received for the whole or any portion of the above quantity.

The Directors reserve the right to accept tenders for the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

Full particulars and printed forms of tender can be obtained on application to the undersigned, at the Gas Office, Duke Street, Liverpool, to whom tenders (on the printed form) must be sent on or before Tuesday, April 28, 1891, endorsed "Tender for Coal."

By order,
WILLIAM KING, Engineer.

Gas Office, Duke Street, Liverpool,
April 2, 1891.

## SUTTON-IN-ASHFIELD LOCAL BOARD.
(GAS DEPARTMENT.)

TO TAR DISTILLERS AND OTHERS.

**THE Gas Committee of the Sutton-in-**Ashfield Local Board are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works during the ensuing year.

Particulars may be obtained on application to the Manager at the Gas-Works, Sutton-in-Ashfield, Notts.

Tenders, stating price per ton of 20 cwt. at the Works, or at Sutton-in-Ashfield Railway Station, to be addressed to the Clerk to the Local Board, Local Board Offices, Sutton-in-Ashfield, and marked "Tender for Tar and Liquor," so as to arrive not later than Tuesday, the 28th of April, 1891.

By order,
G. H. HIBBERT,
Clerk to the Committee.

Local Board Offices, Sutton-in-Ashfield, Notts.

## SUTTON-IN-ASHFIELD LOCAL BOARD.
(GAS DEPARTMENT.)

SUPPLY OF GAS COAL.

**THE Gas Committee of the above Local** Board are prepared to receive TENDERS for the supply of 2500 tons of well-screened GAS COAL and 250 tons of CANNEL, to be free from Shale and Pyrites and to be delivered at the Railway Station, Sutton, in such quantities as the Manager shall from time to time direct, between July 1, 1891, and June 30, 1892.

Particulars may be obtained on application to the Manager, at the Gas-Works, Sutton-in-Ashfield, Notts.

Tenders, stating price, to be addressed as above, and marked "Tender for Coal," so as to arrive not later than Tuesday, the 28th of April, 1891.

By order,
G. H. HIBBERT,
Clerk to the Committee.

Local Board Offices, Sutton-in-Ashfield, Notts.

## SUTTON-IN-ASHFIELD LOCAL BOARD.
(WATER DEPARTMENT.)

SUPPLY OF COAL.

**THE Water Committee of the above Local** Board are prepared to receive TENDERS for the supply of 300 tons of Best Hard COAL SCREENINGS, to be delivered at Mansfield Railway Station, in such quantities as the Manager shall from time to time direct, between July 1, 1891, and June 30, 1892.

Particulars may be obtained on application to the Manager, at the Gas-Works, Sutton-in-Ashfield, Notts.

Tenders, stating price, to be addressed to the Clerk to the Local Board, Local Board Offices, Sutton-in-Ashfield, and marked "Tender for Coal Screenings," so as to arrive not later than Tuesday, the 28th of April, 1891.

By order,
G. H. HIBBERT,
Clerk to the Committee.

Local Board Offices, Sutton-in-Ashfield, Notts.

TO GAS ENGINEERS.

**THE Directors of the Ossett Gas Com**pany invite TENDERS for Four PURIFIERS, each 18 ft. by 17 ft. by 5 ft. deep.

Plans and specifications may be seen at the Offices of the Company from Ten to Four p.m.

Tenders to be sent in on or before Wednesday, the 22nd of April, 1891, and endorsed "Tender for Purifiers."

By order,
JAS. CASTLE, Secretary.

## COLNE AND MARSDEN LOCAL BOARD.

TENDERS FOR TAR AND LIQUOR.

**THE Gas Committee invite Tenders** for their SURPLUS TAR and LIQUOR produced at these Works during the year ending March 25, 1892.

Particulars from the Engineer, to whom tenders must be sent on or before April 20.

HY. SIMMONDS,
Engineer.

Gas-Works, Colne,
March 26, 1891.

## COUNTY BOROUGH OF WIGAN.

**THE Gas Committee are desirous of** obtaining TENDERS for the supply and erection of a SULPHATE WORKS complete.

Particulars from the undersigned, to whom tenders must be delivered on or before the 22nd inst.

The Committee are not bound to accept the lowest or any tender.

JOS. TIMMINS,
Engineer, &c.

April 10, 1891.

## BRIERLEY HILL DISTRICT GASLIGHT COMPANY.

TENDERS FOR GASHOLDER.

**THE Directors of the above Company** are prepared to receive TENDERS for adding a SECOND LIFT to their No. 3 GASHOLDER, which is about 70 feet diameter.

Drawing and specification can be seen on application to me at these Works.

Tenders to be sent in, addressed to me, not later than Twelve o'clock (noon) on Saturday, the 25th of April next, endorsed "Tender for Gasholder."

The Directors do not bind themselves to accept the lowest or any tender.

HENRY M. JACKSON,
Secretary.

Board-Room, Gas-Works,
Brierley Hill, April 6, 1891.

TENDERS FOR GAS COAL.

**THE Directors of the Chertsey Gas** Company invite TENDERS for the supply of 2500 tons of BEST DURHAM GAS COAL delivered free to Chertsey Station during the next Twelve months.

Deliveries to commence on the 20th of May next, and at such times and in such quantities as the Manager may direct.

Tenders, with analysis of the Coal to be supplied, to be sent to the Directors, endorsed "Tender for Coal," on or before the 30th inst.

By order,
JOHN MOIR,
Secretary.

Chertsey, April 11, 1891.

TENDERS FOR TAR AND LIQUOR.

**THE Directors of the Wirksworth** Gaslight and Coke Company, Limited, invite TENDERS for their surplus TAR and LIQUOR for One year, from the 1st day of May, 1891.

Delivery on Midland Railway filled into purchaser's tanks.

Payments, cash monthly.

Sealed tenders, addressed to the Chairman, and endorsed "Tender for Tar and Liquor," will be received on or before the 25th day of April, 1891.

The Directors do not bind themselves to accept the highest or any tender.

Particulars may be had from

B. S. JONES,
Manager and Secretary.

## BUXTON LOCAL BOARD.

CONTRACT FOR CANNEL.

**THE Gas Committee invite Tenders for** the supply of good CANNEL for One, Two, or Three years, at the rate of about 3800 tons per annum, to be delivered at their Siding (on the Midland Railway) in Ashwood Dale, Buxton.

Tenders, endorsed "Tender for Cannel," and addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, not later than Noon, on the 2nd of May.

Forms of tender and other particulars may be obtained of Mr. Geo. Smedley, Gas Department, Town Hall, Buxton.

The Board do not bind themselves to accept the lowest or any tender.

By order,
JOSIAH TAYLOR,
Clerk to the Board.

Buxton, April 11, 1891.

CONTRACT FOR TAR AND LIQUOR.

**THE Buxton Local Board invite Tenders** for the purchase of the TAR and AMMONIACAL LIQUOR produced at their Works in Ashwood Dale during One or more years.

Particulars to be obtained of Mr. Geo. Smedley, Gas Department, Town Hall, Buxton.

The Board do not guarantee to accept the highest or any tender.

Tenders, endorsed "Tender for Tar, &c.," to be addressed to the Chairman of the Gas Committee, and sent in not later than the 2nd of May.

By order,
JOSIAH TAYLOR,
Clerk to the Board.

Buxton, April 11, 1891.

## WYE GAS COMPANY.

**QUOTATIONS are invited for the early** supply of 25 tons of good GAS COAL delivered free to Wye (Kent) Station.

Address W. LEWIN, Post Office, WYE.

## LUDLOW UNION GAS COMPANY.

**THIS Company is prepared to receive** TENDERS for the supply during the months of April, May, and June, 1891, of 200 tons of best screened GAS COAL in quantities to suit the requirements of the Company.

Tenders to be forwarded to J. W. MONTFORD, Secretary and Treasurer, Gas Company, Ludlow, SALOP.

## HULL GASLIGHT COMPANY.

TENDERS FOR TAR.

**THE Kingston-upon-Hull Gaslight Com**pany invite TENDERS for the surplus TAR for One year, the same to be sent in to the Chairman of the Company on or before the 25th of April, 1891.

Particulars may be obtained from

THOMAS BULL, Engineer and Manager.

Gas-Works, Broadly Street, Hull.

**THE Haworth Local Board of Health** are prepared to receive TENDERS for the supply of 1600 tons of GAS COAL, screened and unscreened, to be delivered (in such quantities of either as the Board may determine,) on rails at the Haworth Railway Station within the ensuing Twelve months.

Tenders to be forwarded to me, the undersigned, marked "Coal Tender," on or before the 15th inst.

WM. ROBERTSHAW,
Clerk.

5, Temple Street, Keighley,
April 7, 1891.

TO BUILDERS AND CONTRACTORS.

**THE Directors of the Eastbourne Gas** Company are prepared to receive TENDERS for the construction of a RETORT-HOUSE and COAL-STORES at their Works at Eastbourne.

Particulars are to be obtained on application to Mr. H. E. Jones, C.E., Gas-Works, Stepney, London, E.

Tenders to be sent in not later than Ten a.m., on Monday, the 4th day of May next, addressed to the undersigned, and endorsed "Tender for Retort-House."

The Directors will not be bound to accept the lowest or any tender.

J. H. CAMPION COLES,
Secretary.

Gas Company's Office,
Eastbourne, April, 1891.

## LYTHAM IMPROVEMENT COMMISSIONERS.

**THE Gas Committee of this Board invite** TENDERS for the supply of 1500 tons (more or less) of best screened GAS COAL, also 700 tons (more or less) of best screened CANNEL, and 800 tons (more or less) of washed and screened CANNEL NUTS, per year for One or Three years ending the 31st of May, in such quantities as may be required.

Forms of tender may be had upon enclosing *stamped* and *addressed* envelope to the Manager.

No tender will be accepted unless on the prescribed form.

Tenders, with analysis, fully endorsed, and addressed to the Chairman of the Gas Committee, to be delivered to the undersigned before Twelve o'clock noon on the 30th inst.

The Committee reserve the right to accept the whole or any portion of the quantities required, and do not bind themselves to accept the lowest or any tender.

CHAS. A. MYERS,
Manager.

Lytham, April 10, 1891.

TO COAL AND CANNEL OWNERS.

**THE Directors of The Gaslight and Coke** Company are prepared to receive TENDERS for supplies of COAL and CANNEL for One year from the 1st of July next, in accordance with the terms of their Specifications.

The Company's requirements for the above period will be—

For Coal . . . . . 1,750,000 tons.
For Cannel . . . . . 50,000 "

Deliveries can be made either by Ship in the Thames or by the principal lines of Railway which are in connection with the several Works of the Company.

Copies of the specifications and forms of tender can be obtained upon application at this Office; and all tenders must be sent in before noon on Thursday, the 30th inst., addressed to me, and endorsed "Coal Tender."

By order,
JOHN ORWELL PHILLIPS,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., April 7, 1891.

## NEWCASTLE-UPON-TYNE AND GATESHEAD GAS COMPANY.

GASHOLDER TANK.

**THE Directors of the Newcastle-upon-**Tyne and Gateshead Gas Company are ready to receive TENDERS for the construction of a GASHOLDER TANK, 183 ft. 10 in. diameter, and 41 ft. 3 in. deep, at their Redheugh Works.

Plans may be seen on application to the Secretary, at the Company's Offices, Grainger Street West, Newcastle-upon-Tyne; and specifications, with quantities attached, may be had on payment of 10s. for each copy.

Tenders, addressed to the Chairman, to be delivered at the Offices of the Company, not later than Tuesday, the 5th day of May, 1891.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
WM. HARDIE,
Secretary.

Gas Office, Newcastle-upon-Tyne,
April 9, 1891.

**THE Fareham Gas and Coke Company** invite TENDERS, by the 1st of May next, for One, Two, or Three years' purchase of the surplus TAR and AMMONIACAL LIQUOR made at their Works; delivered free into Tank Barges at the Works, or in Contractor's barrels free into trucks at Fareham (L. & S.W.R.) Station.

Tar to be quoted at per gallon; liquor at per 1000 gallons per degree Twaddell's hydrometer.

The Directors do not bind themselves to accept the highest or any tender.

HARRY SMITH,
Secretary.

Gas-Works, Fareham,
April, 1891.

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WANDSWORTH AND PUTNEY GASLIGHT AND COKE COMPANY.

**NOTICE is hereby given, that an** EXTRAORDINARY GENERAL MEETING of the Proprietors of the above Company will be held at the Company's Offices, North Street, Wandsworth, on Tuesday, the 28th of April next, at Four o'clock in the Evening precisely, for the purpose of AUTHORIZING THE RAISING OF FURTHER CAPITAL, by the creation and issue of Debenture Stock and of New Ordinary Stock, to such an amount as the Meeting may then determine, and in accordance with the provisions of the Wandsworth and Putney Gas Act, 1880.

By order,
W. CROMARTY, Secretary.

Offices: North Street, Wandsworth,
April 7, 1891.

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IMPERIAL CONTINENTAL GAS ASSOCIATION.

INCORPORATED BY ACT OF PARLIAMENT.

**NOTICE is hereby given, that the** HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Association will be held at the City Terminus Hotel, Cannon Street, London, E.C., on Tuesday the 5th day of May next, at 2.30 p.m. precisely, when a Report will be made to the Proprietors, a Dividend declared for the Half Year ended the 31st of December last, and the usual ordinary business of such meeting transacted.

Notice is hereby also given, that the TRANSFER BOOKS WILL BE CLOSED from the 21st inst. to the 5th of May next, both days inclusive.

By order of the Board,
R. S. GARDINER,
Secretary.

30, Clements Lane, Lombard Street,
London, E.C., April 13, 1891.

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CORPORATION OF NEWCASTLE-UNDER-LYME.

EXHIBITION OF
GAS-STOVES, GAS-ENGINES, FITTINGS, &c.,
MAY 4 AND FIVE FOLLOWING DAYS,
AT THE
NEW MUNICIPAL HALL.

**THE Gas Committee of the above Corporation** invite APPLICATIONS FOR SPACE from Persons desirous of Exhibiting GAS-ENGINES, GAS-FIRES, FITTINGS, GLOBES, GAS COOKING-STOVES, AND OTHER APPLIANCES at the above Exhibition.

Application, giving space desired, to be made to the undersigned, not later than the 24th of April next.

W. WINSTANLEY,
Manager and Secretary.

Gas-Works, Newcastle-under-Lyme,
Staffs., April 8, 1891.

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TENDERS FOR LIGHTING BY GAS THE CITY OF PERNAMBUCO, UNITED STATES OF BRAZIL.

**NOTICE is hereby given, that Tenders** for the above service will be received, on or before the 18th of May next, at the Offices of the Secretary to the Governor of the State of Pernambuco (Secretaria do Governo do Estado de Pernambuco).

A copy of particulars published by order of His Excellency the Governor of the said State can be had on application to the BRAZILIAN LEGATION, 35, Piccadilly, LONDON; or to the BRAZILIAN CONSUL-GENERAL, 6, Great Winchester Street, LONDON, E.C.

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TENDERS FOR LIGHTING BY GAS THE CITY OF PERNAMBUCO, UNITED STATES OF BRAZIL.

**REFERRING to advertisement under** the above heading which appeared in the JOURNAL OF GAS LIGHTING of the 7th inst., calling for tenders for lighting the above-named City, under provisions of Contract to be obtained from the Brazilian Legation in London, the Proprietors of the Existing undertaking HEREBY GIVE NOTICE THAT THEY CANNOT RECEIVE THE AMOUNT NAMED IN THOSE PROVISIONS OF TENDER AS THE VALUE OF THEIR UNDERTAKING for the following reasons:—

1st Because the valuation upon which the amount named is based was not made in accordance with the conditions of the existing Contract.

2nd. Because the amount named does not represent the value of the property.

3rd. Because the amount named does not represent even the value as estimated by the Arbitrator, against whose appointment and award they have constantly protested, but a much inferior sum.

The said award of the 18th of March, 1889, expressly declares that the prices named were calculated at the Exchange of 27d. per milreis; and the existing Contract specifically declares that the standard of payment shall be in gold which is equal to 27d. per milreis. But the provisions referred to in the advertisement above named contain no stipulation to this effect, but simply give the amount to be paid in milreis, which, at the present time, are worth in currency under 18d. each.

For these and other reasons the present concessionaires have protested against the so-called valuation in legal form, and will at the proper time take such steps as may be necessary to maintain their rights.

April 10, 1891.

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**LEAFLETS for Distribution by Gas** Companies and Corporation Gas Committees:—

OIL OR GAS FOR LIGHTING OUR HOMES? Price (delivered free) 5s. per 100; £2 per 1000. Larger quantities by agreement. Specimen copy, by post, 1½d.

THE COMPOSITION AND USE OF GAS LIME IN AGRICULTURE. By (the late) Dr. A. VOELCKER, Professor of Chemistry to the Royal Agricultural Society of England. Price 5s. per 100, post free.

THE USE OF SULPHATE OF AMMONIA AS A MANURE. By WILLIAM ARNOLD, Chairman of the Tamworth Gas Company. Price 2s. 6d. per 100, post free.

Published by WALTER KING, 11, Bolt Court, Fleet Street, LONDON, E.C.

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**MR. W. H. BENNETT** having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their Inventions may be secured for Twelve months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

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**DISTRICT ASSOCIATIONS of GAS MANAGERS**
**FOR 1890.**

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**F. SOUTHWELL CRIPPS, Assoc. M. Inst. C.E.**

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**SULPHATE & SULPHUR PLANT;**

**RETORT MOUTHPIECES; CONDENSERS;**

LIFTING APPARATUS; CENTRE AND FOUR-WAY VALVES;

SLIDE VALVES; TAR BURNERS; &C., &C.

**WOOD SIEVES.**

ADDRESSES: 8, Finsbury Circus, London, E.C.; Midland Iron-Works, Donnington, near Newport, Shropshire.

"FORTRESS LONDON." "FORTRESS DONNINGTON."—Telegraphic.

*Price 2s. per dozen, or 10s. 6d. per 100, post free.*

CONSPIRACY and Protection of Property Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

Printed copies of this Section, in large type, on broad sheets, may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

*** *The Act extends to Scotland and Ireland.*

CANNEL

TO BE SOLD CHEAP TO CLEAR OFF STOCK.

10,000 Tons

Put on Rail at 5s. 6d. per ton.

Yield of gas per ton . . . . . 8200 feet.
Illuminating power . . 20·50 sperm candles.
Ammoniacal liquor per ton . . . . 120 lbs.
Tar per ton . . . . . 60 lbs.

A trial order for not less than ten Wagons from any Corporation or Gas Company before purchasing the lot will be accepted at the above price.

Apply to THOMAS FEATHER,
*Colliery Agent & Coal & Cannel Merchant,*
MIRFIELD, *via* NORMANTON.

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SEARCHES made *re* novelty, and opinions given on all matters connected with above. *Full particulars on application to*

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*Special experience in Gas and Ammonia Plant.*

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Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter; and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

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TYNE
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Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP
GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.

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*New Design, with two Cutting Rollers, making less Breeze than their old pattern.*

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SILICA BLOCKS,
BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.

Trade Mark: "SILICA."

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Strongly recommended where EXCESSIVE HEATS have to be maintained.

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SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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*Prices and Analysis on application.*

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NEWBATTLE CANNEL.

QUOTATIONS ON APPLICATION TO
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NEW HIGH-POWER GAS-LAMP.
Westphal's Patent.

Gas Companies should hire these Lamps to their Consumers, and introduce them for Street Lighting as a rival to the Electric Light, as they do not get out of order, are most economical, and the Burner being a circular slit does not choke up.

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RETORT LIDS
OF ALL FORMS AND SHAPES
IN IRON OR STEEL
BY SPECIAL HYDRAULIC MACHINERY.
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ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.
**ALDWARKE MAIN GAS COAL**
Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
*Telegrams: "ATLAS SHEFFIELD."*

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*FOR THE CURE OF STOPPED ASCENSION-PIPES,*
A couple of charges of which will clear a stopped pipe, and an occasional charge keeps them clean, and also increases the make per ton and the illuminating power.
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AUTOMATIC COAL-GAS RETORTS.
GOLD MEDAL, PARIS EXHIBITION, 1889.

*THE CHIEF ADVANTAGES CLAIMED FOR THIS PROCESS MAY BE SUMMARIZED AS FOLLOWS:—*

1. **No skilled labour required.**
2. **Wear and tear of carbonizing tools reduced 50 per cent.**
3. **Great reduction in erection of Ascension-Pipes and Hydraulic Mains.**
4. **Coal carbonized one-sixth quicker than by the old process.**
5. **Absolute control of production by unskilled labour.** (This is most important, especially when there is an extra demand for Gas, as in the case of foggy days, &c.)
6. **Fifty per cent. saving in space of permanent Buildings, thus enabling an old Retort-House fitted by this System to manufacture twice the quantity of Gas.**
7. **This System enables the whole of the old Retorts, Doors, Fittings, &c., to be used (if required) where the Morris and Yan Vestraut's latest improvements are adopted.** (These improvements were described by Mr. Van Vestraut in his Paper read at the last meeting of The Gas Institute. See JOURNAL for July 8, 1890.)
8. **The Morris and Yan Vestraut's System effects a reduction in the cost of carbonizing from 40d. to 10d. (average London prices) per ton of coal, or a saving of more than 70 per cent. in cost of labour.**

This System of Automatically Charging and Discharging Retorts, without machinery or arduous labour, is being largely adopted at the Works of The Gaslight and Coke Co., the South Metropolitan Gas Co., and the Brentford Gas Co., and of several of the Provincial Gas Companies and Corporations.

**This Process is fully Patented, and any Infringer will be strictly proceeded against.**

For further particulars apply to W. M. KIGHT, Secretary, AUTOMATIC COAL-GAS RETORT COMPANY, LTD., 86 and 88A, LEADENHALL STREET, LONDON, E.C. [See Illustrated Advt., p. 665.

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ALSO ALL KINDS OF
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BRIDGES,
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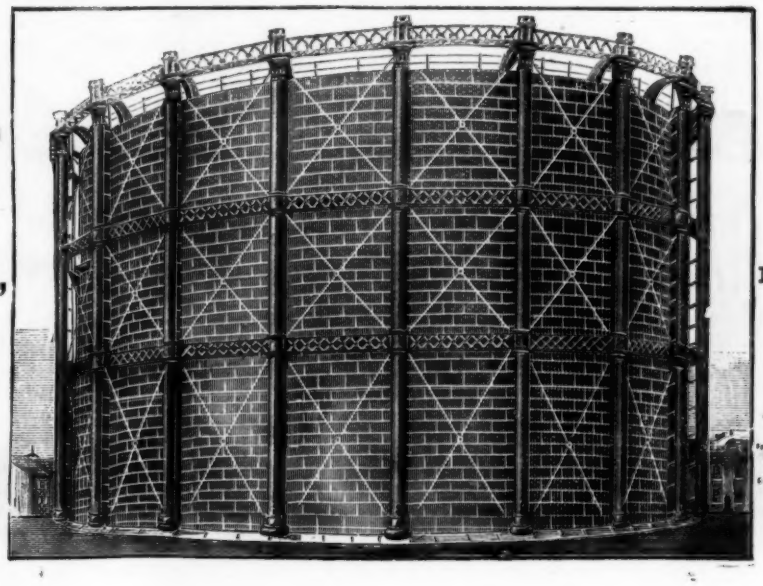

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TELEGRAPHIC ADDRESSES:
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Hislop's Patent Producer and Patent Charging Appliances offer advantages which are unapproachable, while in every other detail his Settings are confidently recommended as being the most inexpensive and effective possible.

*Illustrated Pamphlet and Terms on application to J. E. FISHER, Stourbridge, Agent for England and Wales; to C. M. HAMILTON, Portland Place, Hamilton, Agent for Scotland and Ireland; and for all other Countries to the Patentee,*

Geo. R. HISLOP, Gas Engineer, PAISLEY, N.B.

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**Special Bricks for Intense Heats.**

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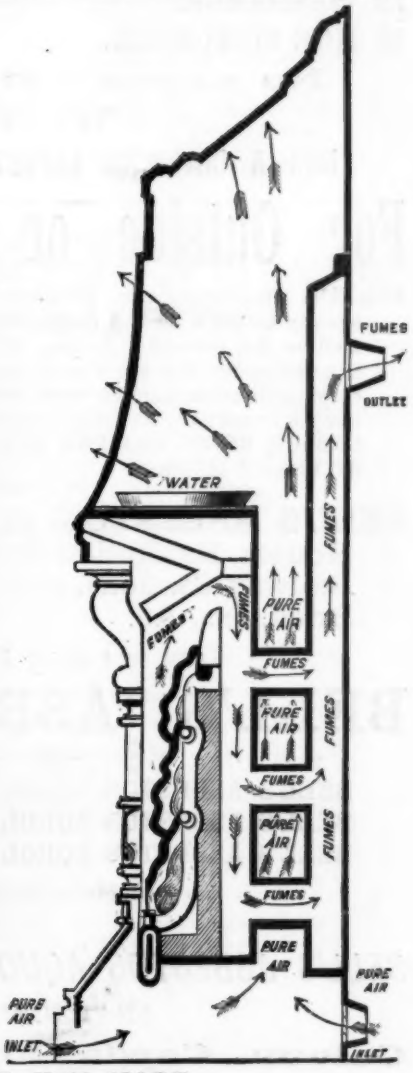


NEAREST APPROACH TO A COAL FIRE YET MADE.

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| Best black finished | £2 5 0 | £2 15 0 | £3 5 0 |
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| Top Panels Electro Nickelled, Brassed, or Copper Bronzed | 2 15 0 | 3 7 0 | 4 0 0 |
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With Hand-Painted Tiles, 10s. to 20s. extra.

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# AQUOL PAINT



## IS MADE READY FOR USE.

IS FIRE RESISTING.
IS WASHABLE.
IS NON-POISONOUS.
IS MANUFACTURED IN ALL USEFUL COLOURS.
IS IMPERVIOUS TO HEAT, COLD, OR WATER.
IS WITHOUT SMELL.

**No expensive Oil or Turpentine required.**

WILL NEVER BLISTER.

HAS A COVERING CAPACITY 40 PER CENT. GREATER THAN LEAD PAINTS.

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**Bell's Asbestos Aquol Paint** is equally suitable for the finest decorative work as well as for general painting. It can be applied over or under any other paint, and, owing to its easy application, can be used with a large distemper brush; the SAVING THUS EFFECTED IN LABOUR BEING 50 PER CENT. OVER THAT OF LEAD PAINTS.

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*Those who Study Economy and Protection from Fire should use only*

## BELL'S ASBESTOS AQUOL PAINT.

**BELL'S ASBESTOS AQUOL PRIMING is made Ready for Use.**
**BELL'S ASBESTOS AQUOL PRIMING stops all suction of Wood, Cement, Plaster, &c.**
**BELL'S ASBESTOS AQUOL PRIMING should be applied to all New Work.**

**Suitable for Ceilings, Walls, and New Wood, and is very durable.**

*BELL'S ASBESTOS AQUOL KNOTTING, for Stopping Knots in New Work.*

**AN EXCELLENT CURE FOR DAMP WALLS.**

**Colour Cards and Price Lists on Application.**

Supplied in Casks of 5 to 7 cwt., and Iron Drums of 28, 56, and 112 lbs., Sample Tins of 7 and 14 lbs.

Owing to its Covering Capacity, a SAVING IN FREIGHT of 40 per cent. is effected for a given surface.

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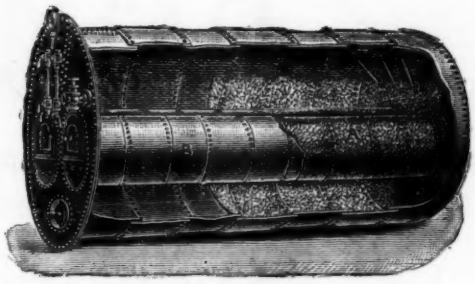
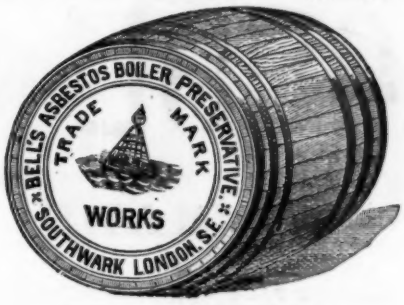
# BELL'S ASBESTOS BOILER PRESERVATIVE

**Will remove Incrustation from Steam-Boilers of all kinds without chipping.**



A shows Boiler Plates when incrusted.
B shows Boiler Plates when cleaned by this Composition.




Every Cask is sent out as above.

The action of this **BOILER PRESERVATIVE,** by absorbing the free oxygen that is in the water, **entirely checks pitting and corrosion.** It also disintegrates incrustation so immediately as to prevent its adhering to the plates; and the deposit falls to the bottom in a loose powder, which is easily swept out. By keeping boilers clean, a **great economy of fuel is effected,** and the danger of the plates burning is entirely obviated; thus avoiding the great risks which are inseparable from scaled plates, lengthening the life of a boiler, and **covering its own cost a hundredfold.** Whenever possible it should be used through Feed Pump or Injector, which it will also keep clear from incrustation. The small quantity required to effect its purpose makes this the most economical, and more than repays the higher price we charge for a fluid which, in the case of many other makers, is useless.

**QUANTITY REQUIRED.** A quarter of a pint weekly per horse power indicated; where the water is very bad rather more, or one pint for every 700 gallons of water evaporated.

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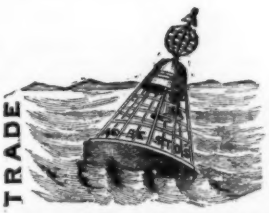


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BEST LOCOMOTIVE PACKING made.

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Is specially suited for Hydraulic Machinery, Accumulators and Ammonia and all Pumps.

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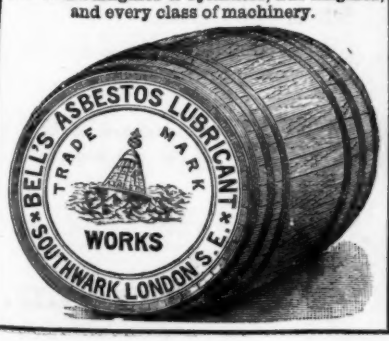
Is unequalled
For Steam-Engines & Cylinders, Gas-Engines, and every class of machinery.




## BELL'S ASBESTOLINE
The reputation of this Lubricant is based on the experience of thousands of users, which places it far in advance of those who rely only on mere laboratory tests.

ASBESTOLINE IS THE CHEAPEST MOST EFFICIENT, CLEANEST MOST INODOROUS AND SAFEST LUBRICANT.

ASBESTOLINE HAS SAVED 90 PER CENT. OVER OIL.
Has been used for all purposes, AND BEATEN ALL OTHER LUBRICANTS IN ACTUAL WORK.

BELL'S ASBESTOS
## EXPANSION SHEETING
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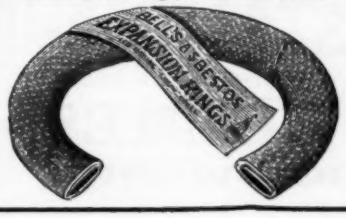
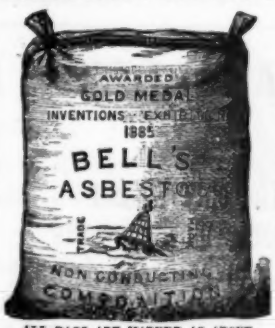
Is the most efficient and reliable Material for Manhole, Mudhole, Steam-Pipe, and all other Joints.




BELL'S ASBESTOS
## NON-CONDUCTING COMPOSITION.




Will reduce loss by radiation and saves 40 per cent. of fuel.
Is superior to any other, and saves its cost in a few months.
Can be applied again after many years' service.
Is sent out dry in bags; therefore cheaper than others sent out wet.

ALL BAGS ARE MARKED AS ABOVE.

BELL'S ASBESTOS
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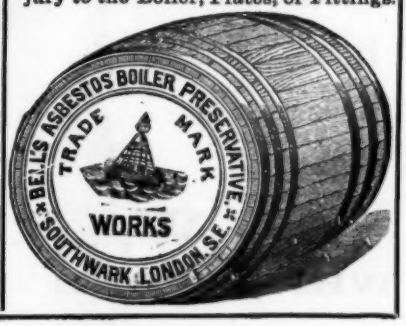
Will effectually keep Boilers clean, and remove any Incrustation, without injury to the Boiler, Plates, or Fittings.



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Flanges made to suit requirements.

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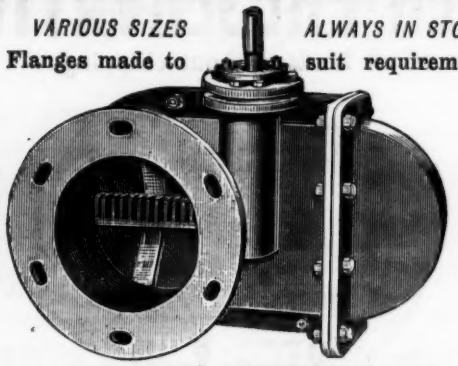


OUR-WAY VALVES.

FLANGED RACK AND PINION VALVE.

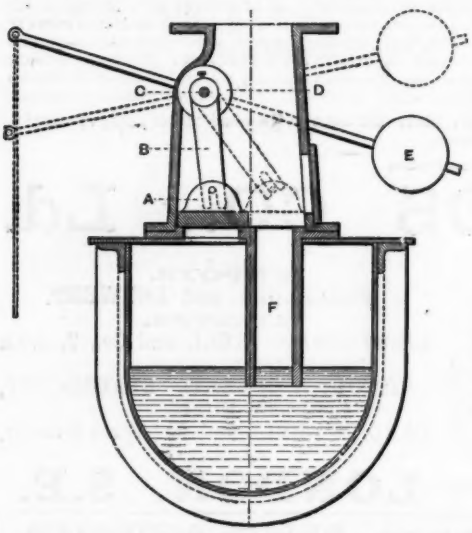
**H. WHYTE, TIPTON, STAFFS.**

# JONAS DRAKE & SON.

—GAS— —ENGINEERS— —CONTRACTORS— —IRONFOUNDERS— —RETORT SETTERS— —ETC.—

**Specialities in CARBONIZING PLANT.**
**GENERATOR AND REGENERATOR FURNACES.**

**OVENDEN,**
**HALIFAX** (YORKS.)




# MEIKLEJOHN'S
PATENT
# IMPROVED SLIDE-VALVE ANTI-DIP

Is perfectly reliable in action, and requires no attention.
Has all the advantages of the Dip and Anti-Dip combined.
Is cheap, and easily fixed to any form of main.
Will save more than their cost in one season's working.

MR. THOS. NEWBIGGING'S REPORT.

*5, Norfolk Street, Manchester, Dec.* 11, 1889.

Sir,—I have examined your Anti-Dip arrangement, and have seen it at work on the Retort-Benches at the Longwood Gas-Works, and the opinion which I have formed of its simplicity and certainty in working is distinctly favourable; so much so *that I consider it to be, without exception, the most efficient Appliance of the kind which has yet been introduced.* It can be applied to existing Benches with great ease, and at a minimum cost. So far as I am aware, it embodies a principle of action not previously applied in this direction.—Yours truly, Thos. Newbigging.

Further particulars from the Sole Patentee and Manufacturer,

**NEILL MEIKLEJOHN,**
GAS ENGINEER,
LONGWOOD, HUDDERSFIELD.

*** During the serious illness of Mr. Neill Meiklejohn, all communications as to the above should be addressed to C. Meiklejohn, Gas Engineer, Oldbury, near Birmingham.

# SAVILLE'S PATENT REGULATOR WASHER

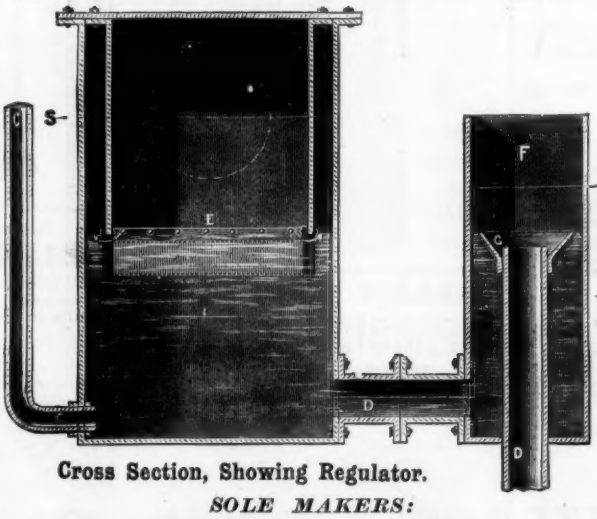
(As described in the Journal of Gas Lighting for Sept. 2, 1890.)

The only Washer without moving parts that can be fixed before an Exhauster.

No more Gas spoilt by over-running the Exhauster.

Perfectly Self-acting.

Particulars and prices on application.




Cross Section, Showing Regulator.

The only safe arrangement to work without Dip.

Less wear and tear on the Exhauster.

No moving parts.

Occupies small space.

State maximum make of Gas per diem.

*SOLE MAKERS:*

# W. C. HOLMES & CO.,
**WHITESTONE IRON-WORKS, HUDDERSFIELD.**

# WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS,
Near LEEDS

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

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NEAR BIRMINGHAM
(Established 50 Years),
PATENTEES
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IMPROVED GASHOLDERS AND BOILERS

and Manufacturers of every description of

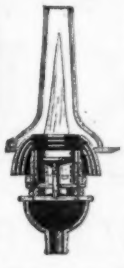
Gas Apparatus,

Cast and Wrought Iron Tanks, Purifiers, Condensers, Scrubbers, Retort-Lids, Cross-Bars and Screws, Wrought-Iron Boilers for Stationary, Portable, and Marine Engines, Sugar Pans, Coolers, Clarifiers, Punts, Boats, Bridges, Girders, Roofs, Cisterns, Oil-Tanks, Melting-Pots, Crucibles, Salt-Pans, Arch and Range Boilers, and every description of General Ironwork.

Drawings, Specifications, and Estimates supplied.

# THE NEW "DOUGLASS"
# PATENT GAS-BURNERS

(Sir Jas. N. Douglass's Patents).



Burners upon the "Douglass" principle are now on the market for ordinary purposes as used by the Government and at the following Lighthouses: The Eddystone; Dungeness; Whitby; Scilly Rock; and many others.

GIVE A PURE WHITE AND BRILLIANT FLAME.
Without Smoke or Chimney Breakage.
CONSUME LESS GAS, and give a more POWERFUL LIGHT than any other Burner yet devised.
SIZES FROM 15 TO 3000 CANDLE POWER.

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GAS COAL AND CANNEL FACTORS.

Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.

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Gas-Bags for Mains. High-Water Boots. Woollen Miners' Jackets.

Delivery and Suction Hose, Gutta-Percha Acid Bottles, Leather Driving Bands, Woven Canvas Hose for Fire-Engines, Wedge and Square Gas-Bags, Air and Water Beds for Invalids, Oil Tarpaulin Coats, Trousers, Hats, &c., Squeegees for cleansing Pavements, &c., Billiard and Bagatelle Cush, Tricycle Tyres, Leather Hose, Cotton Waste, Engine Cloths, Oils, &c., India-rubber Waterproof Garments for Walking, Driving, or Sporting Wear, Diving and Wading Dresses, Printers' Blankets, Iron Wheels and Rollers covered with India-rubber, and Stokers' Gloves.

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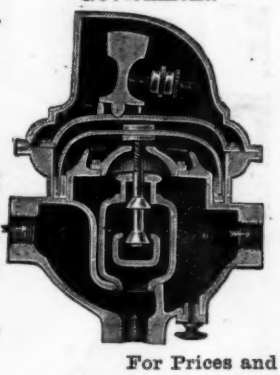
## AUTOMATIC
# GAS GOVERNOR

As supplied to and approved of by H.M. Government.

The most reliable Automatic Method of economizing Gas without reducing the Illuminating Power.



HUNDREDS ALREADY FIXED.

# FLOOR
# WARMING STOVES

(LEEDS' PATENT).

CAN BE SUPPLIED FOR EITHER GAS OR OIL.

THESE STOVES ARE

*CLEANLY, PORTABLE, ECONOMICAL,*

And applicable for all kinds of Rooms where a Comfortable and Wholesome Atmosphere is desired.

For Prices and further Particulars, apply to the Manufacturers,

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Ground in Oil (as Paste)
in 5-cwt. Casks.
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Ready mixed for use in
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**3/-** per gallon.

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CARRIAGE PAID ON ORDERS OF OVER £5 IN NET VALUE.

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# RETORT SETTINGS IMPROVED

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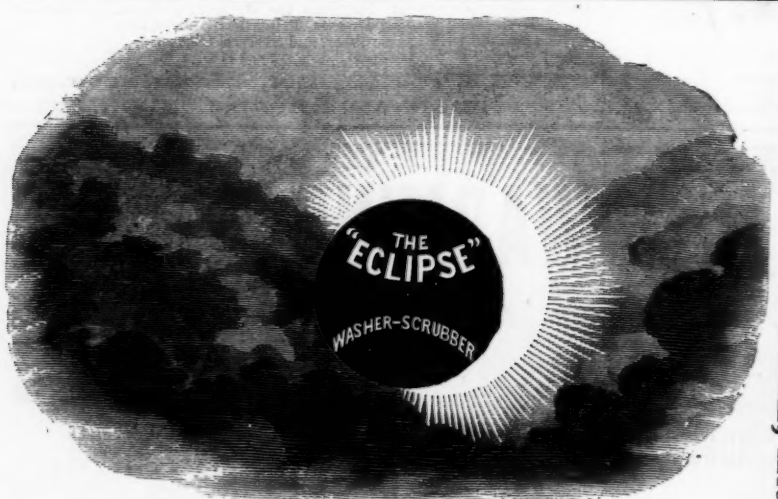


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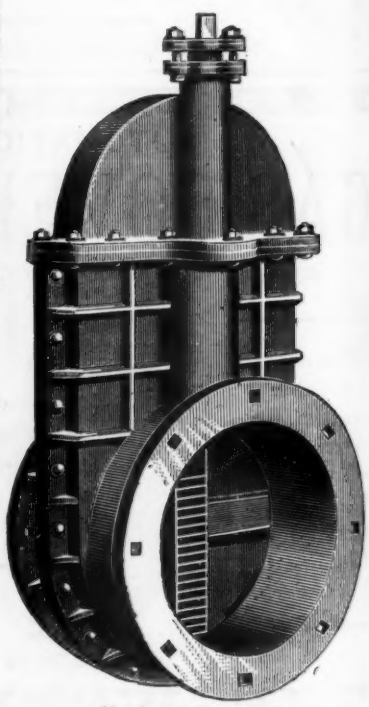
**SILVER MEDAL, Inventions Exhibition, 1885.**



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London: Printed by WALTER KING (at the office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, April 14, 1891.